American Machinist

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1936 Will Bring . . .

MORE MACHINERY ORDERS
SKILLED LABOR SHORTAGE
LESS POLITICAL TINKERING
BETTER EXPORT BUSINESS

K. H. CONDIT

Editor

"AMERICAN traditions and customs sanction the folly of making forecasts at the end of each year concerning the prospects for business during the coming year. In compliance with the obligation thus placed upon business commentators the present writer hazards the following expressions of purely personal opinion about the prospects of business during 1936."

That paragraph I have lifted bodily from the exceptionally able discussion of the outlook for 1936 which Col. Leonard P. Ayres presented before the Cleveland Chamber of Commerce several days ago. It expresses my own sentiments so exactly that I can but echo it.

What are the prospects for 1936? In my "purely personal opinion," fortified by discussions with some twenty critical observers of the trend of business, they are as follows:

1. A general improvement in business activity for the metal-working industry which is more than likely to develop into a period of prosperity unparalleled in our experience.

2. As a corollary to 1, the industry will run into a growing series of industrial disputes induced by shortage of skilled workmen, and will make feverish efforts to train men by establishing all sorts of apprentice programs, vestibule schools and the like.

3. Politics, 1936 being a presidential year, will absorb a lot of the time of business men and manufacturers which might much better be spent on the affairs of their businesses and shops, but will not be able to do more than slow down the wave of recovery somewhat.

4. Foreign trade will improve markedly all over the world, largely as a result of the trade treaties negotiated by Secretary Hull, *unless* (I have to hedge a little on this one) a serious war breaks out in Europe or in the Far East, or else politics steps in to block the Hull program.

Why will the metal-working industry be more active? The simplest answer is "obsolescence." It is too simple, of course, but the fact remains that back of almost every type of recovery we have had, or that lies ahead of us, is some form of obsolescence.

Take automobiles as the shining example. They have become an essential part of the every-day life of the average American family, urban or rural, and as they wear out they must be replaced. Furthermore, they have been so improved in the past year or two that the old ones, even though they are far from worn out, by comparison are hopelessly out of date, in performance as well as in appearance.

Capitalizing on these two powerful sales factors the automobile companies have already achieved a considerable measure of recovery. Automobile men are beginning to talk of a four and a half million car year, and there have been murmurs of five million. Many old cars have been replaced during the last year, but many more are due for replacement just the minute their owners get the necessary cash or the confidence that times are going to be enough better to warrant the gamble of a down payment. All of which means that the major market of the metal-working industry is very much alive. It means also that those employed in the automobile industry, and in all its supplier industries, are busy again, making money, paying off their debts and investing in more of the consumer products of the industry.

Other branches of the consumer product division of the metal-working industry are also doing well, and promise to do better in 1936. Sales of radios reached 5,000,000 in 1935; they should be as good next year. Electric refrigerators at 1,600,000 units and ranges at 225,000 units set new records and are expected to maintain their upward trend.

As for agricultural machinery, that has been doing very well, thanks to the

Underwood and Underwood

beneficence of Mr. Roosevelt, Mr. Wallace and their AAA. It bids fair to do well in 1936. If the Supreme Court tells the farmers' friends that their way of helping was not quite according to the rules they will find another way to do the job, for there is an election next fall. In fact, the new plan is even now supposed to be well in hand so that there may be no stoppage in AAA payments.

The railroads? What they need most of all is more traffic. They will get it in 1936, and when they do an appalling condition of obsolescence in equipment will be painfully evident. For the first time in many years it begins to look as though a car shortage is imminent. Several roads have ordered cars in the last 30 days. Most of them will have to if traffic approaches normal. And that means business for the heavy industries, laggards in such recovery as has already occurred.

THE KEY to the whole recovery problem, of course, is the heavy industry group. As it revives, railroad traffic keeps pace, and thereafter each stimulates the other. Let's see what the prospects are for various branches of the machinery-building industry.

Machine tools are even now back to the 1926 level which is taken as the normal year for many of the charts of business indicators. This level is one-third above the 15-year average for the industry. The cumulative effects of the very successful show staged by the National Machine Tool Builders' Association in Cleveland last September will be evident early in 1936.

The shops of the metal-working industry still house machine tools two-thirds of which ought to be replaced

ALFRED P. SLOAN, JR.

President, General Motors Corporation

"It is perfectly possible to accelerate the progress of 1935 and to broaden it into a sound forward movement extending all along the line of constructive endeavor."

(*American Machinist's* 1935 Inventory of Metal-Working Equipment). At the present rate of activity in the machine-tool plants we are not quite holding our own against obsolescence. In other words, the percentage of overage machinery is rising gradually. I confidently expect that this trend will be reversed in 1936, in other words that the machine-tool builders will build and sell enough machine tools to reduce the obsolescence percentage somewhat.

Why so confident? Because the obsolescence is as bad, or worse, in other kinds of machinery, all of which must be built on machine tools. No figures comparable to the *American Machinist* figures for machine tools exist except for equipment in industrial power plants; 65 per cent of it is over ten years old. Replacement has been

COL. LEONARD P. AYRES

Vice-president, Cleveland Trust Co.

"The volume of business discussion will reach unprecedented heights, while physical production and new enterprise will be restricted to modest progress."

very limited in extent during the past year. There is every reason to believe that it will be doubled in 1936.

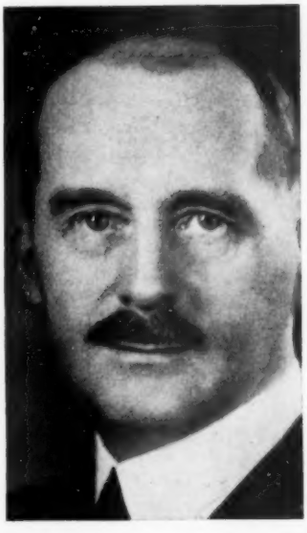
In the power plants of the public utilities there is a slightly different picture. Not only is there obsolescence to contend with, but also expansion, made necessary by a power load that has broken all records in recent weeks. The generating plants of many power companies are approaching the limit of their capacity.

Hard times have held back equipment purchases in the construction industry for several years. Insistence of short-sighted legislators and incompetent administrators on the use of hand work instead of machines has also had its effect. But in the first six months of 1936 this industry will have at its disposal from government and private funds twice as much money as it had in either of the full years 1934 or 1935. The market for second-hand contractors' equipment has been sold out for weeks. Is it any wonder then that those closest to this field predict business for the makers of construction equipment at least double that of 1935 and probably more?

Textile mills have been doing better lately and as a consequence they are likely to spend during next year at least $150,000,000 for new machinery and possibly as much as $200,000,000. Competition from Japanese plants fitted out with the most modern textile machines has been hard to meet with obsolete plant and the higher wage scale that prevails in this country.

1935 was a fairly good year for machinery sales to the coal-mine operators but 1936 is likely to be better because wages are set for more than a year ahead, there is a market to be regained, and the only way open is through mechanization. One builder of coal-mine machinery looks forward to the best two years in the history of his company.

In the metal mines the prospect is not so rosy. New equipment is very much needed but since most of the



plant is operating at not much better than 25 per cent the prospect for sales is not particularly favorable.

Several important modernization programs are planned for 1936 in the various branches of the process industries. 1935 was a fair year in this field,

with 1935 10 per cent better, and 1936 likely to be 20 per cent ahead of 1935.

What will happen in the food industries remains to be seen. Millions of dollars are in escrow until the Supreme Court passes on the legality of the AAA processing taxes. If this money should be returned to the companies a large part of it would be spent for modern food processing machinery. In this conection it should be remarked that income taxes are likely to make inroads into the sums returned to the companies in case AAA taxes are thrown out.

What has been said about the industries just mentioned holds true in large measure for the other industries to which the metal-working industry sells machinery. The prospect for better business in 1936 is, therefore, excellent.

TWO WEEKS ago, on the air, Mr. Cameron of Ford Motor Company pointed out that of the 8,800,000 normally employed in manufacturing between 80 per cent and 90 per cent have been re-employed. His reason for mentioning these figures from the Statistical Abstract of the Department of Commerce was to point out the absurdity of placing on industry the onus for reemploying the estimated nine million Americans still idle. But the figures can be used to prove another point—the need for training men for the skilled jobs.

It should be obvious to anyone that the more skillful men will be given jobs ahead of their less able brothers. With better than 80 per cent returned to work the chances are that those still out need training before they can hope to hold down the kinds of jobs that are open now and will be multiplied this coming year. In those sections of our industry which have experienced a fair measure of recovery this difficulty of securing adequately trained men has been acute for months. It will be aggravated in 1936.

A few of the old line comprehensive apprentice training schools have carried on during the depression but they are hopelessly inadequate as training centers for the number of men that will be needed. Thoughtful employers everywhere are giving careful consideration to the training problem and various solutions have been worked out depending on the type of industry, the size of unit involved and the situation in the community concerned. A Federal Committee on Apprentice Training at Washington with state and regional sub-organizations is doing what it can to stimulate interest in and action toward the setting up of additional training units. There can be no question but that the metal-working industry will find that employee training will be one of its major worries during the coming year.

1936 is a presidential election year and tradition has it that business always suffers during such years. The tradition is not too well backed up by the economic statistics. During 1936, however, it is reasonable to expect that a good many business men and manufacturers will decide that the election of the right sort of President to cope with the problems that face us during recovery will be more important than personal attention to the problems of their own enterprises. To the extent that such men leave their business affairs in the hands of less skilled subordinates business and industry will suffer. My belief is that, even so, the tide of recovery is too strong to be retarded to any great extent by any political barriers that can be foreseen now.

GERARD SWOPE

President, General Electric Company

"For the year 1936 we look forward to a continued improvement in business."

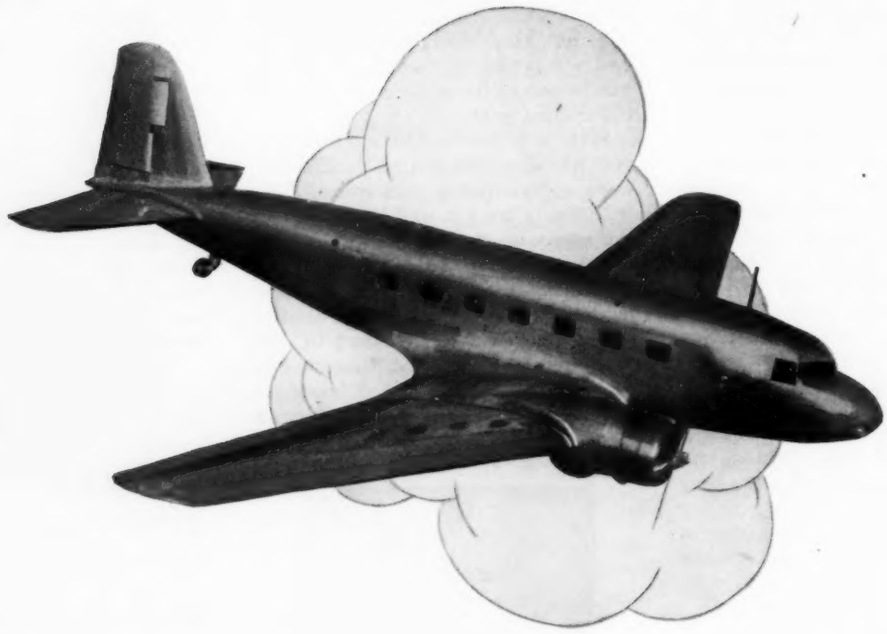
In any political campaign emotion is likely to get the better of reasoned judgment. The 1936 campaign will be no exception. From the business point of view a presidential candidate with constructive ideas and a record of achievement will be more acceptable, regardless of party, than one with a violent reform urge. When business is sick it is willing to try anything that offers any hope even if it is diametrically opposite in principle to what has always been considered economically sound. When business is well on the road to recovery, however, it looks askance at political experimentation no matter how benevolent the experiment and the experimenter may be.

There can be little doubt that the predilections of the present administration lean toward the left. Nevertheless the political strategists of this administration are wise enough to recognize the difficulty of winning an election with the business interests of the country united solidly against them. As a consequence we may expect that business will be subjected to less baiting than has been its lot during the past year and a half.

The foreign trade outlook is most encouraging, always excepting the outbreak of general warfare in Europe or an open break between Japan and Russia in the Far East. Secretary Hull's reciprocal trade treaties promise to do much to restore the volume of trade that prevailed prior to the war of tariffs that broke out several years ago. From the point of view of the metal-working industry the terms of the trade treaties so far completed have been distinctly favorable. Of the treaties so far negotiated the Canadian treaty is by far the most important and its reduction of the Canadian tariff rates on all kinds of machinery and metal products cannot but stimulate exports to Canada, one of our largest metal-product markets.

One of the most serious hindrances to international trade has been the quota system devised by various European countries to set up barriers even more nearly insurmountable than high tariffs. The treaty with Switzerland is proof that the quota system can be broken down, and should be most encouraging to the metal-working industry. Freeing of frozen credits in certain South American countries and elsewhere will have a stimulating effect on machinery exports.

In conclusion I should like to reiterate my conviction that the economic forces of recovery are too strong for the blunders of politics to resist. In predicting better times in 1936 I count upon this fact and upon the essential sound sense of the American people and their indefatigable ingenuity to overcome all obstacles.



RIGHT GEARS for WRIGHT ENGINES

H. R. LeGRAND
Assistant Editor

And "right" means overcoming the bugaboo of distortion despite the light sections inherent in aircraft design

AN AIRPLANE rushing swiftly to its destination is now regarded as a commonplace, even by children. So many pioneering flights have been made, so many great commercial airlines are operating on frequent schedules that flight is no longer a novelty. Like the steamship, the railroad train and the automobile, the airplane has outgrown its unusualness and is now valued chiefly for its facility of transportation.

What has caused this great change in attitude? Merely evidence that the air transportation industry is equipped to render the service of a common carrier. The word "equipped" is used advisedly; it is a matter of common knowledge that the industry now has the planes, engines and ground facilities to carry out its everyday business.

Back of this highly integrated structure is a supply industry that has made possible the success of the former. One of the chief branches is the business of aircraft-engine manufacture, and one of the most important units thereof is the corporation that proudly bears the name of the two brothers who made the first flight some 32 years ago.

Intensive development in the intervening years has put the Wright Aeronautical Corporation of Paterson, N. J., in the position of building engines for every type of military and commercial aircraft. More than 96 per cent of the parts going into the Cyclone, Whirlwind and Conqueror engines are built in this plant. Because of the comparatively large number of gears used in radial-type engines, 31 in all, the gear department is a good-sized shop in itself. These gears are much lighter than those used in other fields of transportation. Their light sections introduce special problems in preventing distortion.

The gear department is set up to perform such operations as general machining, gear cutting, grinding, lapping and inspection. Forged blanks are bought outside. After inspection they are normalized to 25-30 Rockwell and sand blasted. Machining operations are usually completed before cutting the teeth, which is done on Fellows or Gleason machines. Nearly all of the gears are of the spur type.

Gear cutting procedure at the Wright plant is much the same as elsewhere. Three general precautions are observed: The machine must be kept in first-class repair; Grade A cutters are used (the best that the cutter people make); and clamping is carried close to the root of the teeth in all cases to assure proper support.

An example of the care exercised to prevent any distortion during cutting is shown in Fig. 1. At *A* the pump drive cluster gear is clamped and supported through the solid section so that no bending occurs in the web while cutting the small gear. Another

adapter *B* assures the same condition for the larger gear. Next, all corners or sharp edges are broken with files or wheels to prevent the starting of cracks in quenching. This process is repeated as one of the very last operations to take care of any sharp edges left after grinding.

Before heat-treatment the gears are plated on the sections that are not to be hard. Carburized gears are copper plated; nitrided gears are either nickel plated or tin plated. As fast as possible the company is going to tin plating because it has been found almost 100 per cent impervious to ammonia gas whereas nickel plating is not.

Carburized parts are made of SAE 3312, a nickel-chromium steel. Nitrided parts are made from a special material developed by the company's metallurgist. Its composition is as follows: carbon 0.38-0.45; chromium 1.40-1.80; molybdenum 0.30-0.40; aluminum 0.95-1.30; manganese 0.40-0.70; phosphorus and sulphur 0.004 maximum. Core hardness of carburized parts is 32-40 Rockwell and rim hardness 60 minimum. Nitrided gears have a core hardness of 290-321 Brinell and a case hardness of 750 to 1,100 Vickers Brinell. The depth of case is as follows: carburized, 0.025-0.035 in.; nitrided, 0.020-0.030 in. These values are all for highly stressed parts.

DISTORTION has not been a serious problem up to the point of quenching, but now becomes of paramount importance. All of the gears are subject to disastrous warping if some means are not employed to prevent it. Therefore at the Wright plant each gear is quenched in a die, using a Gleason quenching machine. Details of representative dies will be given with the specific practice for certain gears. Suffice it to say here that each case is a special problem.

Wherever possible these gears have ground tooth form. Finish grinding is done on a Pratt & Whitney two-wheel hydraulic gear grinder. Enough stock is left so that lapping will remove all grinding marks and fuzz which is important in reducing noise. A check of the gears discloses that the involute is accurate to 0.0002 in. and the concentricity to 0.0005 in. Location is taken from the bore which is ground to 0.0005 in. in a previous operation. Lapping likewise takes location from the bore, the work being done on a Fellows machine. Backlash is then checked. It must be within 0.002-0.006 in. and preferably 0.003 in. for all gears operating at moderate speeds. For the supercharger gears, which operate at high speeds, this allowance is reduced to 0.002-0.004 in.

Accuracy of gears is controlled mostly by rolling fixtures that have master mating gears with ground tooth form. A Parkson gear charter and an Illinois involute measuring machine are located in the gear department and are used mainly for checking the machine equipment rather than production checking of parts. Occasionally the Parkson device is utilized for making a record of each gear of a certain type that may have unusual service load. A gear which might fail in service can then be checked against the Parkson record, and the fault discovered if it lies in gear cutting. Main reliance is placed on two running tests when the engine is assembled. After the first 5-hr. test the engine is torn down and all parts inspected. The "proof of the

Looking at the "works" of a Wright Cyclone; some 800 hp. are delivered to the propeller by this planetary reduction drive

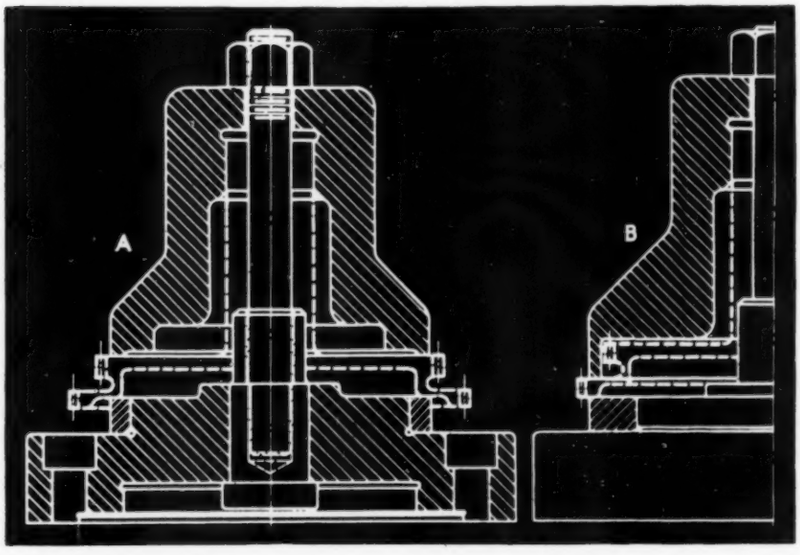


Fig. 1—During gear cutting, support is carried as close as possible to the root of the teeth to prevent distortion

pudding" here is whether the gears have stood up satisfactorily.

TWO types of inspection are used—a spot check on the floor and complete checking in the inspection department. Each operation when started is checked against the operation sheet by the floor inspector to insure correctness before the batch is run off. Before such major operations as heat-treating, the part is checked completely in the inspection department. When all the operations are completed the gear goes to final inspection where every detail is checked minutely. One test here is the Magnaflux treatment which shows up cracks due to grinding and any other cracks or flaws that are invisible. In the Magnaflux treatment the magnetized part is put in a bath containing iron oxide. A crack in the part causes an intensification of magnetic flux at that point, attracting the iron oxide particles. They form a heavy black line that is instantly detected on the polished surface as a crack. After passing this test the gear goes to finished stock for assembly.

It has been found that cracks detected by the Magnaflux process are mainly due to side-wheel grinding. The amount of stock left for grinding does not make any difference. Should the crack occur in the first 0.001 in. removed, it can not be ground out but goes progressively deeper. It was, therefore, necessary to eliminate side-wheel grinding and to replace such operations with face wheel grinding. This precaution applies only to carburized surfaces. Of course, when the top surface is removed by face grinding it is possible to remove a small amount of material with the side of the wheel without danger of cracks or checks.

So much for the general picture of gear practice at the Wright plant. Details of specific gears will be given in a forthcoming number to show what problems arise and their solution.

Back to Day Rates

M. P. DALTON
Sevenoaks, Kent, England

THE STRIKING article by Charles B. Gordy under this title (*AM*—Vol. 79, page 161) calls for several comments. The type of factory that he discusses is definitely special and of the mass production type only. There are many other mass production plants that have not the long sequence of sameness common to the automotive plant. Also, there are many jobbing and contract plants that must be considered. Efficiency ratings can be worked out only in certain cases where repetition is continuous, or where the product is costly. All engineers do not agree with these systems. Many think it better to use the money of time study and the brains applied to efficiency systems for producing better methods, relying on over-all results to tell if the production men are doing their jobs right.

I have frequently pointed out that payment on incentive systems should not be attempted until all other departments of management are efficient to the last degree. It seems likely that the change back to day rates is largely recognition of the too early application of payments by results. In my opinion, time study is waste. Operation study, though similar, is vitally different, in that the expense is incurred solely to improve output. From what I have seen and read of time study, it seems that much money is being spent to discover what is happening in the shops, when that time would have been better spent in planning details before starting the job. Better still, at the estimate stage.

Again, group payment is all right within limits in a big automotive plant, but it is not the best system in a shop that has not the advantages of timed conveyors to force the pace. Group incentive never works efficiently, because there is always someone in the group who does not do his best. With personal payment, each man does his best or he goes.

Another curious point is the remark that the hourly rate without the addition of bonus may not yield a sufficiently good living wage, but that is the negation of incentive payment. It is imperative that the men be satisfied with their standard of living before the bonus payment is added, or the bonus does not carry the full incentive value. The man who knows that he does not get a living wage without hard work will not produce the same speed-up as the man who reckons himself well paid before striving for incentive payment.

Taylor, I believe, did not suggest that the hourly rate should be reduced when incentive payment is introduced. As a case in point, I know a shop where the hourly rates were much above its competitors' levels, and where piecework bonus amounted to over 100 per cent. Yet that shop beat all competition, and on very tight jobs. The high rate of output reduced the overhead charges enormously.

As to the reasons given for the change back to day rates, I agree that the complications of the former system, even the simplest straight piecework one, is a bugbear; that many managers do not agree that there is any value in the complicated efficiency systems. Also, that they seem to produce a state of chronic strike complex, and that the throwover payment into the next pay period is always a trouble-making procedure.

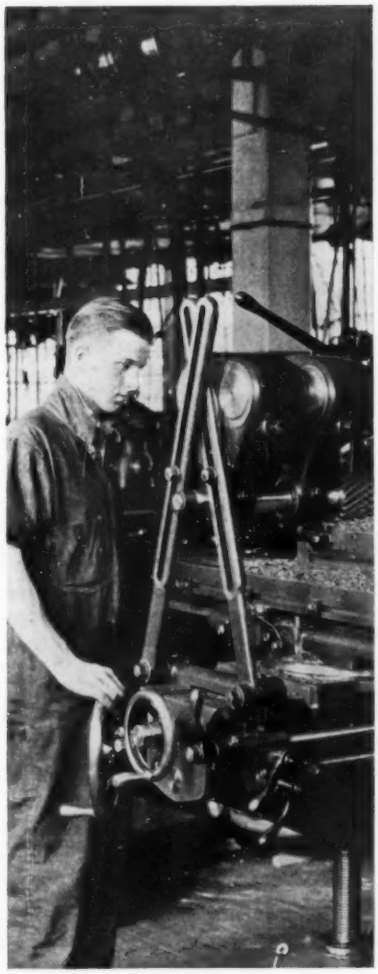
To illustrate the slackening of individuals in group systems, I know of one case where the group system did not exist, yet one worker never did any work although he had earned good money on straight piecework. Somehow he persuaded the men to do his work for him. He was eventually made a foreman and believe me that shop hummed. Why? Well what the eye does not see, the heart does not grieve for, and it was no business of the management how the results came about, as long as the workers were content.

In another shop, the foreman took a heavy weekly levy from the men without their authority. Again, management did not interfere because that foreman got results, while his men got bonuses that were impossible under any other foreman. If these things are possible, what chance is there of the average group system working fully?

Now the sting of Mr. Gordy's article is, perhaps unconsciously, in its tail. "Furthermore, with alert operating supervision individual merit may be recognized and rewarded." That "may be" needs watching. Having gotten rid of payment by results, management is now in that desirable position where it can introduce what changes and improvements it desires without fear of a row when the rates are fixed. There are many who think that the improvement in operating efficiency entitles the worker to a share in the results—in sheer justice. Management is not likely to give that extra to labor, now that payment by results is going west. Any move to displace payment by results is a move to lessen labor's advantage from good work.

CRAFTSMEN Must Be TRAINED

J. E. GOSS
Employment Manager
Brown & Sharpe Mfg. Company



It is no longer possible to get skilled workmen from "somewhere"

WHERE shall we get our toolmakers, machinists, repair men, draftsmen, molders, pattern makers, estimators, foremen, and others with skill and a background of all around experience, unless we train them? Too long have we expected to get them from "somewhere," and now, with business still below normal, we are finding it difficult to secure satisfactory employees in many skilled lines.

There are several reasons why some have done so little about apprentice training. One, probably, is that it seems so remote from immediate profits. A new machine will turn out maximum production as soon as the power is applied. A new apprentice will not be a skilled worker for several years; perhaps about the time we fall into another depression.

But what is the alternative? Ten years ago it was claimed that the machine would replace the skilled man. At best, this was simply an excuse. True, the machine has specialized some of the trades to a point where the semi-skilled man does a part of the work formerly done by the craftsman, but there still is, and no doubt will be for generations to come, enough trade value remaining to warrant apprenticeship.

Where is the machine that will do our jig and fixture work, produce our punches and dies, repair our broken mechanisms, build our patterns, mold our larger castings, make our drawings, or do the work of our foremen and supervisors?

THE man who wants to argue may ask why our trade schools should not be our source of supply. We can get the answer to this simply by comparing trade school hours with factory time and considering the project method alongside actual production requirements. The metal trades industry cannot pass the training responsibility along to anybody else.

Some of the smaller shops have done nothing about training apprentices because, so they say, they do not have the facilities for an all-around course. In some areas where there are several machine shops a "community apprenticeship plan" provides for the changing of apprentices from one shop to another in order to carry out a complete program. Such a plan has been operative in Providence for the last few years. Several of the shops in this plan cannot give their apprentices planing or thread-milling. At the right place in the program the supervisor simply arranges with a shop which has this kind of work to take the boys for a specified length of time.

Even without a community plan many smaller shops probably can do a very good job of apprentice training. In some cases there may be one or two kinds of machinist work which cannot be given because of lack of facilities, but if what can be done is done thoroughly the apprentice, when he finishes his training course, at least will be prepared to do the skilled work in the shop where he was trained. What little he may need to be a machinist elsewhere usually can be acquired readily.

Apprenticeship should not be confused with operator training. The latter certainly is neither apprenticeship nor a substitute for it. If we call a six months' course in the operation of a certain machine an apprenticeship, we might as well call a process server a lawyer, and grant a physician's license to a corn-doctor.

Recently we have read of short training periods which were called apprenticeships. These have their place in industry, but they never should be confused with a three or four years' training covering all phases of a trade.

APPRENTICESHIP does much more than teach boys how to operate machines and use various tools. It instills a spirit of loyalty and implants stability in young men who might otherwise shift about in search of the never-to-be-found ideal job. It serves as a very solid foundation on which to build supervisory personnel.

There must be system to it, or it will fail. Not red-tape system but the kind that we need for the orderly conduct of other phases of our business. A superintendent who hands a boy over to a foreman with the information that the boy is to serve four years as

an apprentice is wasting the time of his shop and the boy's time also.

The apprenticeship system of the Brown & Sharpe Manufacturing Company of Providence, Rhode Island, is built on a century of experience in training mechanics.

It includes, first, the sources of supply of raw material which has produced the best results.

Other things being equal, sons of foremen and long-service employees are given preference, but no applicant is enrolled merely because of these connections. Our management, well aware that a young man close to an executive, or other employee, is not necessarily a good prospect for apprenticeship, exerts no influence or pressure whatever. This is a point which might well be considered by anyone starting or carrying on an apprenticeship program.

Applications are filed for future consideration only when the applicant is rated as a prospect. Although no obligation to enroll is assumed by filing an application, it would be unfortunate for many applicants not to be told at the outset that their applications would not be accepted.

Apprentices are started as individuals rather than in classes. The reasons for this are that the openings for both beginners and those finishing their training present themselves singly, and that there is greater ease of change from one department to another during the course. Related subjects, called class work, correlate with the shop program, so that each individual follows his own schedule.

THE selection of apprentices is of the utmost importance. To leave the choice wholly to a trial period is not good enough. Such a plan is a waste of the beginner's time, the foreman's time, machine time, materials, and of some other more suitable boy's time.

Our selection is made on the basis of school records, letters from school principals and teachers, personal interviews, mental ability tests, mechanical aptitude tests, and a physical examination.

If the applicant successfully passes these preliminary steps he is started, when we have an opening, on a three-months' trial period. All shop operations are performed in the regular shop departments on a wage-incentive basis. While there may be some good arguments for a vestibule school or for the isolation of apprentices, it is our opinion that the place for an apprentice to learn shop practice is in the shop itself.

Much besides the operation of various machines should be learned. For example, the potential foreman should learn the ways of workmen, by daily association.

Our idea in putting apprentices immediately on the wage-incentive plan is to instill into them the understanding that there are two major factors in production—quality and quantity. The young man who learns how to do a good job, with no thought of the time element, will be, we believe, not as desirable a journeyman or foreman as one who has been thoroughly trained in the importance of time.

During the trial period monthly reports are made by the sub-foreman, department foreman, shop instructor, and class instructor. In addition to these, attendance and efficiency ratings are considered. At the end of the three months a final report is made and in this all concerned must not only rate the candidate by means of the usual marks, but state their opinion of the young man as a prospect for development in his chosen trade.

IF THE beginner successfully passes the trial period and wishes to go on with his course, he is required to sign, together with his parent or guardian, an agreement to remain with the company for four years (in the case of machinist apprentices), the three-months' trial period counting as part of the first year of apprenticeship.

It is important that an agreement be signed if the boy is to go on learning the trade, and that such agreement be made both in legal form and in a manner to protect the employer as well as to merit the respect of the boy and his parents.

Our agreements are in printed form, but for a shop employing only a few apprentices this is not necessary. However, agreements such as sometimes are made, in longhand on a piece of pad paper, certainly should be avoided. They lack the dignity due the transaction and the psychological effect which helps in keeping the apprentice on his course.

It long has been our practice to require the parent or guardian to pay a fee when the agreement is signed. In the case of machinist apprentices the amount is $50. When the apprentice finishes his training we pay him a bonus, the amount for machinists being $150.

The agreement specifies the number of hours that the apprentice shall serve to complete each year, or period, of the course. Hours are credited by the timekeepers, from the clock cards.

The question of pay often has been a debatable one by employers considering apprenticeship plans. Our policy is to start boys at a rate which will permit those from out-of-town to pay their board and room rent, and finance their other necessities, then to increase this two or three cents per hour every six months. Many of our beginners have paid their own way and thriftily saved the fee money during their trial period.

Too low a rate will prevent worthy boys of little means from taking a course, while a rate too high may attract those concerned more about money than education.

It is essential to follow a carefully planned program in both the shop and the classroom. No doubt many attempts at apprenticeship have failed because of the lack of a definite plan.

If we get good prospects for development they will be the discriminating kind, rightly unwilling to spend four valuable years in a haphazard way. Our apprenticeship activities are centralized, and all changes in the shop program, from one department to another, are made by the apprentice supervisor. So far as possible, these changes are made so that a newcomer to a department replaces a boy who has completed his assignment in that department.

ON THE completion of an assignment, a printed form is sent to the supervisor, bearing the foreman's rating of the apprentice in workmanship, deportment, industry, and mechanical judgment, and these ratings are transcribed on what we call a History Card. In addition to this there is the Foreman's Interview Report on which the department head answers such questions as: "Does the apprentice feel that he has learned all that the time would allow? As a prospect for development do you consider him to be good, fair or poor?" Apprentices are mainly under the supervision of the instructor and the sub-foreman, but the interview plan assures contact with the department head.

Besides following the regular program of shop operations, we have analyzed each kind of work, such as lathe work, drilling, milling, grinding, and have printed these analyses on pocket-size cards.

When an apprentice is assigned to a milling section, for example, the shop instructor writes the young man's name on one of the cards on which milling operations have been itemized. As the apprentice learns each part of milling machine work, the items are checked by the instructor, on the card. If the section to which the apprentice has been assigned happens not to have a

certain operation, such as spiral milling, during the assignment, the apprentice is temporarily shifted to another section to learn this part of the job. The cards are helpful both to the apprentice and the instructor, since by their use a complete understanding of the work is assured.

Related subjects are taught in our own classrooms, and instead of text books we use our own loose-leaf system. This facilitates keeping the material up-to-date, and serves thereafter as a reference.

All class work is on shop time, included in the contract hours, and apprentices are paid the regular hourly rates while in the class-room. At the beginning of each apprenticeship year, the learner is given a printed schedule of school sheets so that he knows at any time how his school work stands in comparison with his apprenticeship hours.

Sheets requiring corrections are returned to the apprentice and may not be filed in his reference book until all corrections have been made satisfactorily, and the sheet stamped as having been accepted.

EVERY six months, reports are made to the parents. These include a summary of shop ratings, classwork marks, efficiency percentage, attendance figures, spoiled work, and any notation which the supervisor thinks advisable to notify the parents as to the progress the apprentices are making.

Included in the class work are courses in foremanship and estimating.

The foremanship course consists of such subjects as selecting help, handling men and importance of production; also lectures by heads of departments with which apprentices do not ordinarily come in direct contact. We have found it of great value for the better apprentices to be informed as to the functions of advertising, sales, cost accounting, traffic, time study and the like.

A few days ago one of our ex-apprentices, who is now a director of vocational education in a distant city, told us that he recently had passed a college examination in personal relations entirely as the result of his recollection of the discussions in this course.

The estimating course was planned to develop skill in job planning and estimating production time. So that apprentices will keep pace with up-to-date practice, the subject material is taken from newly timed jobs and blue prints in current use.

All class work in both courses is rated by the instructors, and the marks are noted on the history cards.

As a means of bringing our apprentices in touch with officials we follow a schedule of interviews, whereby each apprentice talks, periodically during his course, with an official or higher executive from whom he may gain inspiration. Immediately following an interview, the official dictates his impressions of the caller, and these reports are kept by the supervisor. They have been found very helpful in placement at the end of the training period.

Those concerned vitally with apprentice training recognize the value of activities somewhat outside the regular curriculum, yet leading toward desirable development of skilled and supervisory employees.

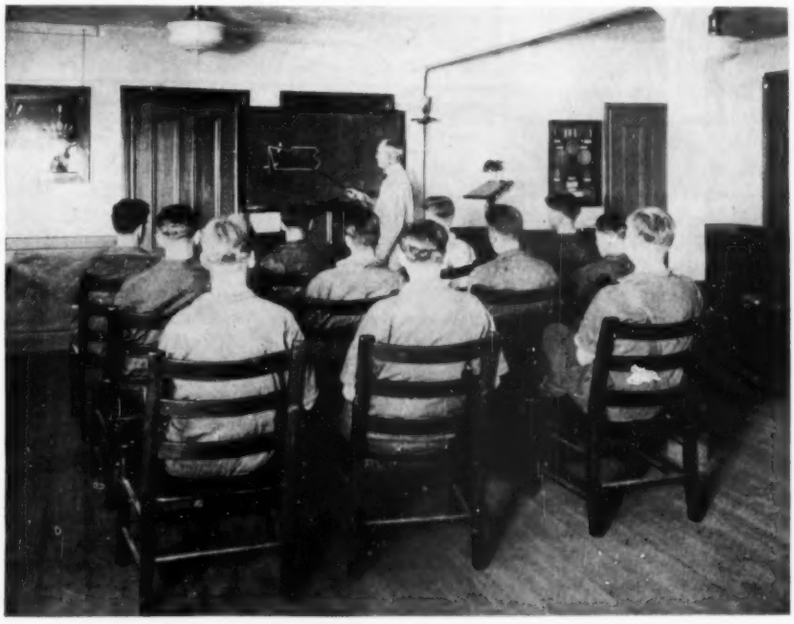
Our monthly apprentice paper, *The Techno-Scope*, has long been the means of furthering executive ability in members of the editorial staff, and writing ability among apprentices in general. This publication is not confined to technical subjects, but includes humorous bits such as every lively young man enjoys.

An annual dinner, a field day, and a tennis club help in promoting good fellowship. Dormitories provide for the proper housing of boys from outside Providence.

VISITORS sometimes give us the impression that our apprenticeship work is thought of, outside the factory, as an intricate system, strictly regulated and functioning almost automatically. Such is not the fact.

At the foundation is a family spirit. There must, of course, be a program and a means for carrying it out, but if it is to be effective it should take cognizance of the individual aptitude, ability, aspiration and capacity for growth. Probably no other class of worker in our factory is nearer to management than our apprentices.

Employers have told us that they do not now take apprentices because of experiences wherein young men went elsewhere on completion of their training. It would be interesting to know just why most of these changes were made. Could it have been the employers' fault? Very emphatically can it be said that young men who have learned a trade will remain if they can see that their oportunities are at least equal to those which they would meet elsewhere.



Apprentices are paid their regular rate for work in the classroom

A systematic check-up of ex-apprentices in our employ is carried on for many years following apprenticeship. The idea behind this is that, so far as possible, each man shall be rightly placed, both as to pay rate and job. It is poor business to train a young man and thereafter fail to make the best possible employment of his potentialities.

Apprenticeship can result in loyalty, reasonableness, good workmanship and efficient leadership. If management, generally, will start the job promptly and carry on systematically the metal trades industry will find itself much better able to cope with a situation rapidly becoming more and more serious.

. . . you're the first toolmaker in my fourteen years as a foreman who has ever showed me a try-die

TRY A TRY-DIE

CHARLES WESLOW

RECENTLY, Mac, my foreman, gave me the job of making a bending die for a flat spring item. It was made of clock spring steel, 0.052 in. thick and ½ in. wide. I insisted on making a try-die first. "A what?" retorted Mac. "A try-die," I repeated.

Mac shrugged his shoulders, and showed an incredulous disposition toward such an undertaking. "If I can't get your approval in making it before I make the real die, then give the job to someone else," was my final contribution to the controversy. Mac then put his mythical John Hancock onto my old-fashioned run of things.

When I completed it, I showed it to him, saying, "Here, this is what we used to call a try-die." He looked it over and said, "Weslow, you're the first toolmaker in my fourteen years' experience as a foreman, who ever showed me a try-die, and I can see it's a time saver."

But first of all, a cold-rolled, soft brass, or aluminum sample of the item must be made by hand, bending the corners around steel or cast iron blocks in the vise exactly to the blue print specification.

A try-die need not be so constructed that it bears a punch holder or a die shoe, but it should be operated in a press of the same pressure in which the real die is to function.

To get an approximate idea as to what angle the try-die should be laid out in order to obtain the angle for the real die, fasten a piece of the clock spring in the vise, against one of the bending blocks used in making the sample. With the use of a toolmaker's parallel clamp bend the spring around by hand, and measure how it is bent, using a protractor for the purpose, let it spring back, until you find how far forward it must be bent in order to get it sprung back to the specified angle. Then lay out the angle of the try-die, and proceed to make it. But in reality, we have merely commenced, inasmuch as the vise method has helped us merely to get the try-die under way. The try-die just leads us toward the proper angle of the real die.

We can always rely on obtaining accurate angles in the real die by altering the radius of the corners *E*, Fig. 3.

For experiment, bend a piece of half-hard brass, which is more suitable for this purpose, around a given radius, to say 45 deg., and note how many degrees it will spring back. Then reduce the radius, and you will find that the brass will not spring back so much; the smaller the radius, the less it will spring back. Try it with a sheet of paper for that matter.

A TRY-DIE need not be made so as to produce the item to specifications, but merely to find the proper angle for the real die, in the bending performance. As the try-die is made just to get that information and nothing else, it can be much shorter than the real die. In connection with this subject, I am presenting features in the real die untried before.

Whether or not the item to be made is ½ in. wide or 1½ in. wide, get out a piece of the material ⅝ in. wide, which is ⅛ in. less than the width of the try-die, and you will need several

such pieces before you are through with the try-die, which is purposely made only ¼ in. thick, for reasons you will learn further on.

The upper sketch in Fig. 2 shows a side and end view of the try-die for this particular item. The lower sketch shows a side and end view of the guide plates, which are made out of $\frac{1}{16}$-in. thick cold-rolled, having separator plates *B* sandwiched in between and held in place with ⅛-in. dowels that are easily removed. The distance between the two separator plates is about $\frac{3}{64}$ in. more than the width of the punch. The side plates and the separator plates, which guide the punch, are centralized by placing the sample between the punch and the die and then clamping the guide plates onto the die with toolmaker's parallel clamps, as shown. It is evident that the punch and die need not be fastened in the press.

IN CASE the die or punch, or both, have the wrong angle, all we need do to change it is to saw in with a hacksaw, bend the die or punch, and hold it secure by means of taper wedges as shown.

In case we need an enlarged radius in the try-die at *A*, swage it in as at *C*, and if swaging fails, drill a hole there and drive in a taper pin, which is sure to force the metal out so it can be filed to suit. Thus you will see why the try-die is made only a ¼ in. thick. If it were thinner, it would be too difficult to handle such narrow blanks. When the angles are altered the position of the separator plates must be changed, too, but all we need do is drill the dowel holes elsewhere.

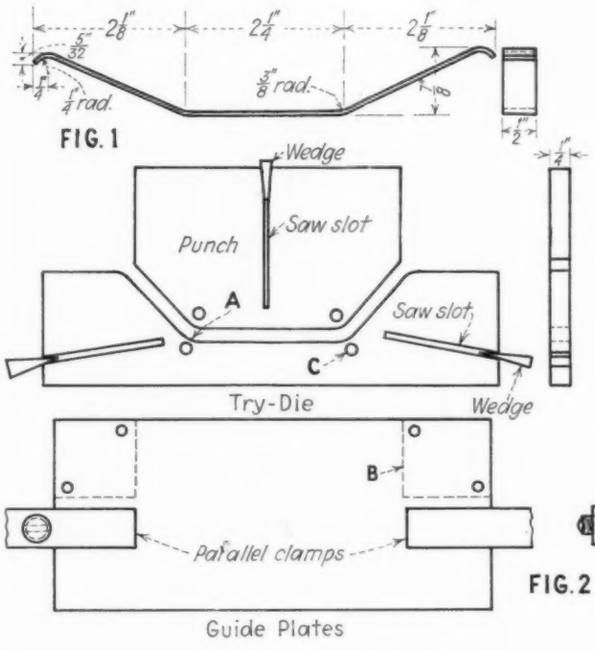
Some toolmakers seem to want others to believe that they can very nearly "guess" the correct angles and radii of a bending die, but that's a lot of boloney. They spend in the end a lot of the boss's time, developing the real die, which after all doesn't grow but has to be made into shape.

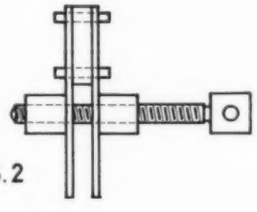
For ordinary bending dies, pack-hardened cold-rolled is best because it can be bent if heated to a straw color, providing it need only be bent slightly.

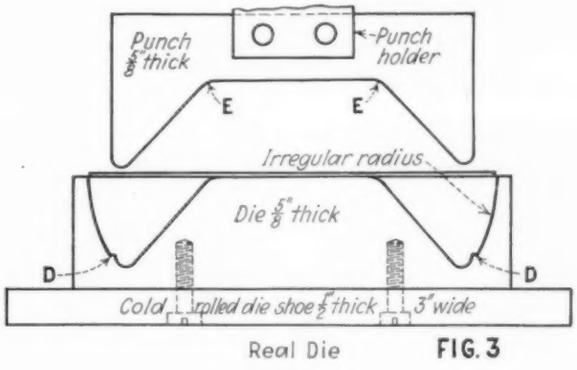
The real die, as shown in Fig. 3, requires no spring pad nor spring pressure pins to keep the blank from slipping, since any slip the blank may tend to make is prevented by the fact that the ends of the blank follow an irregular radius at the ends of the die, which are determined by fastening a thin piece of sheet brass or cold-rolled onto the side of one end of the die, after the latter has been roughed out to an approximate radius. By using a blank piece of clock spring steel about ⅛ in. shorter than the developed blank, the irregular movement of the end of the blank, as it is being pressed down, can be scribed onto the thin plate, which can be cut out as a templet from which the die is fitted. When the ends of the developed blank strike the crinkles at *D*, the short bends take place, and by then the blank is secure in the die from slipping because the blank is already bent around the corners at *E*.

IN ORDER to lay out the punch from the die, allowing for the thickness of the metal to be formed, just clamp the punch onto one side of the die, and scribe off the punch with a scriber made of drill rod of the same size as a double thickness of the metal, or make a scriber of B. & S. ground tool steel, the same thickness as the metal to be formed, sharpening the end as shown in Fig. 4. When the punch of the try-die is wedged open, the top surface should be ground off straight again and parallel to the bottom as originally shaped, and the bottom of the dry-die should be treated likewise, if that member is altered with wedges.

Gages to hold the blank in position, are not shown, but are simple cold-rolled pieces at both ends of the die.







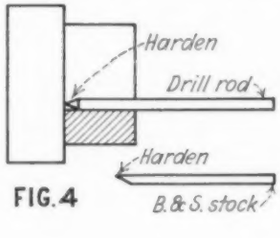
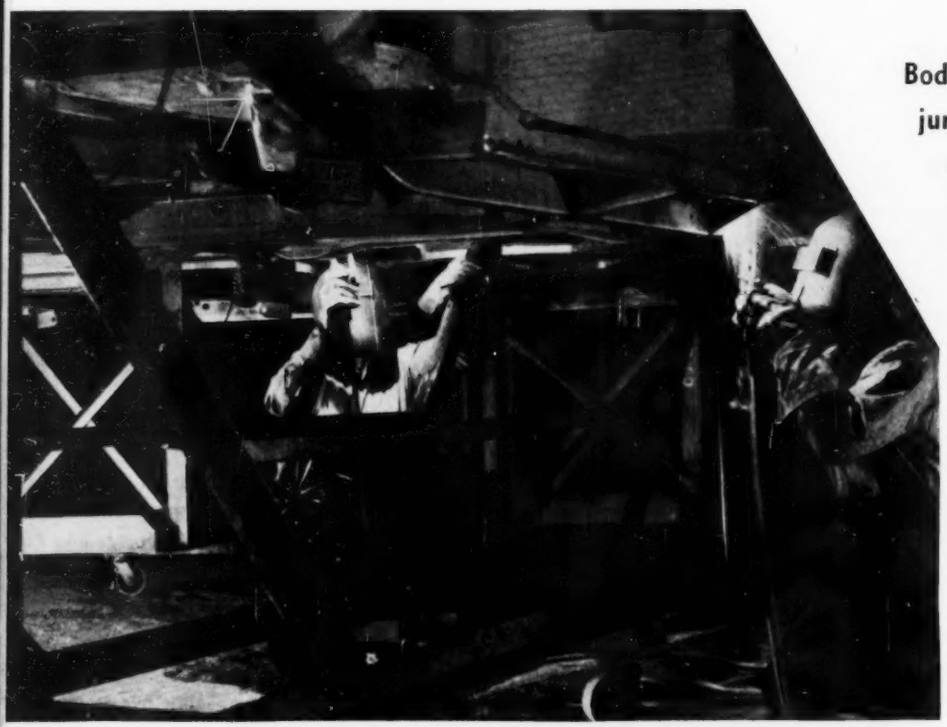


Fig. 1—Made of 0.052 in. spring steel, this piece forms a good example of work on which the try-die comes in handy. Fig. 2—The try-die, which is operated between guide plates, may be corrected by means of saw slots and wedges.

Fig. 3—The irregular radius at each end of the die keeps the blank from slipping while the bends are made at B. Fig. 4—A scriber made from drill rod or B. & S. flat tool stock is useful in laying out the punch from the die

MORE WELDS MAKE the ZEPHYR

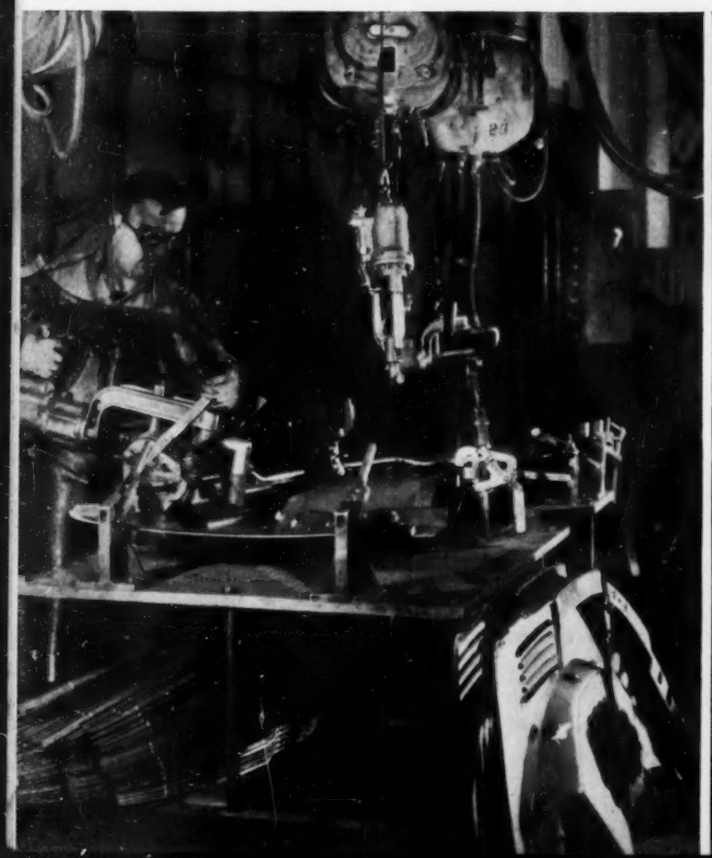


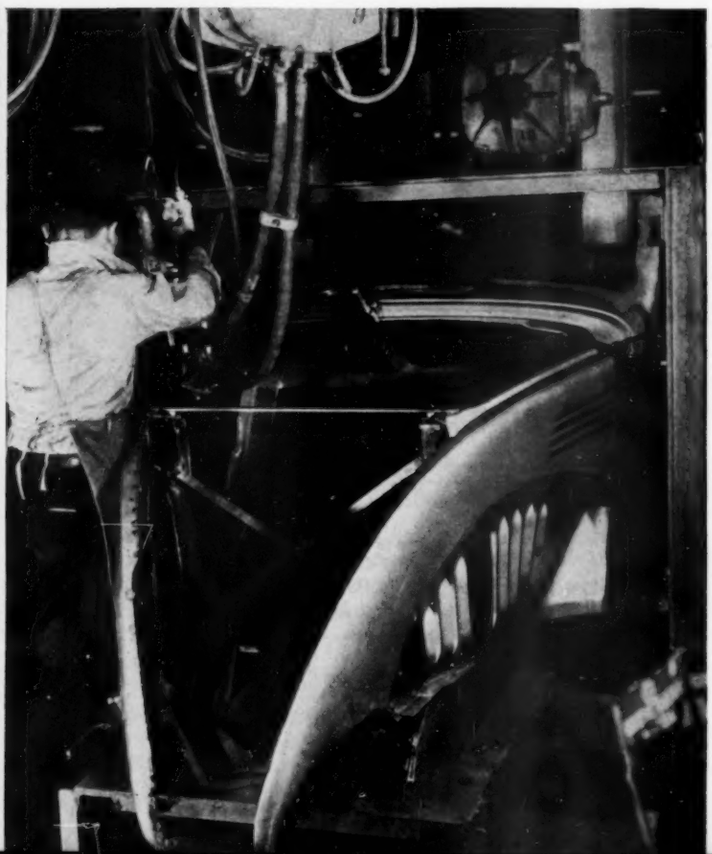
Body fabrication of Lincoln's junior model was recently described (AM-Vol. 79, page 909); here are some additional views

Left—With the work mounted on a special dolly, the foundation, or floor section, is completed by arc welding

• *Lower Left*—A quick-operating jig holds the front wheel housing while the gun weld speeds fabrication

• *Below*—As may be seen by this cowl assembly, welding plays a major rôle in jig as well as body construction



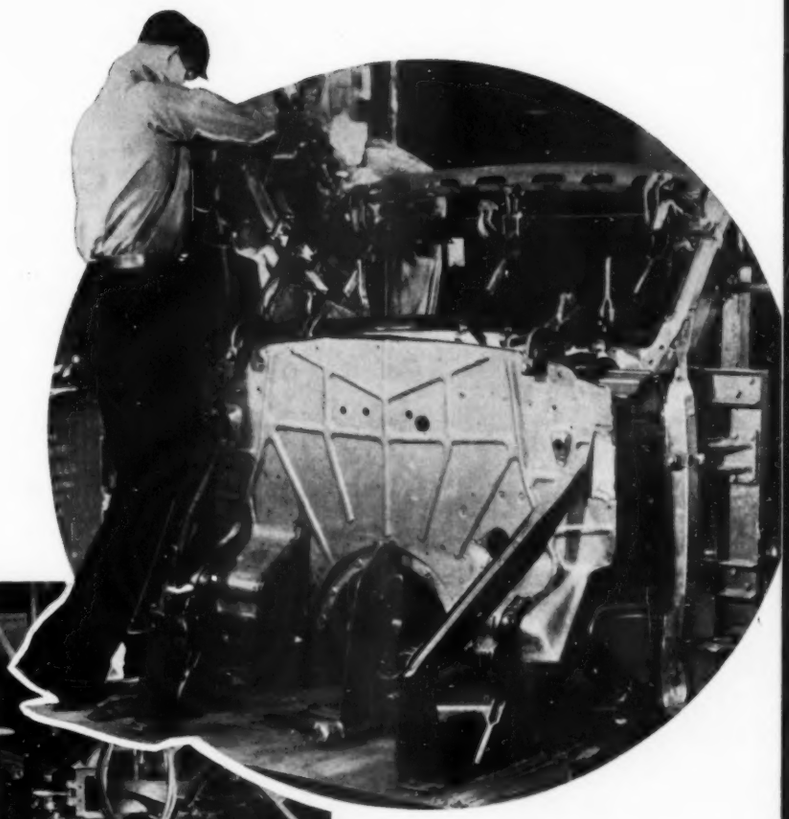


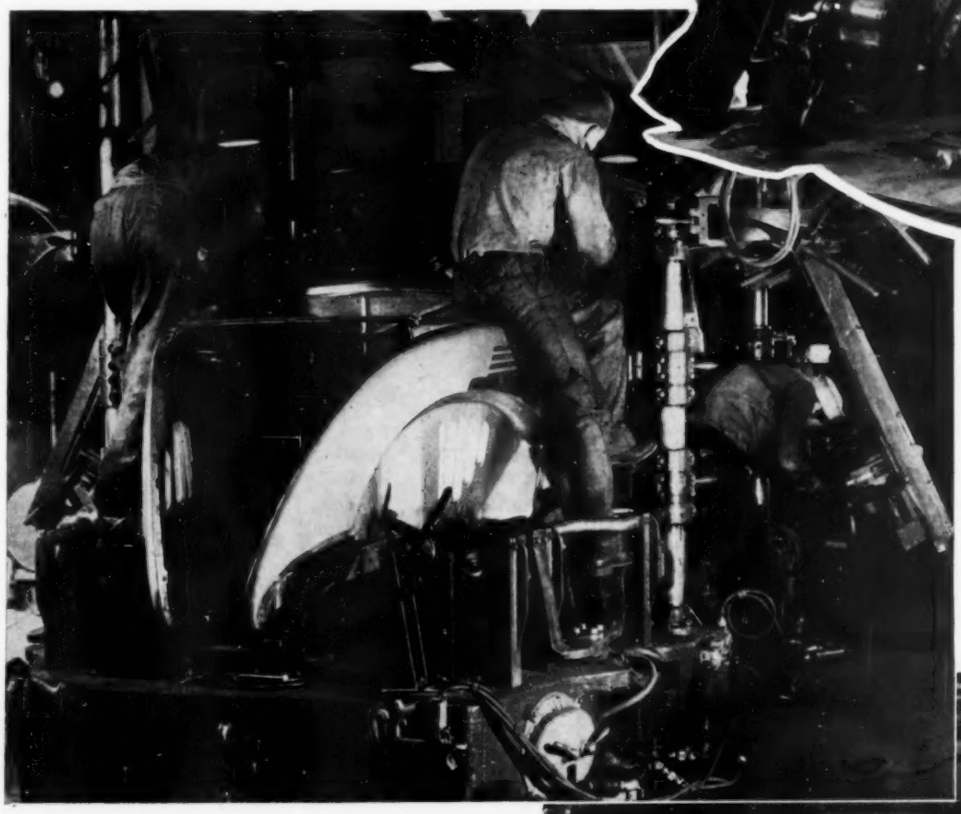
Right—In joining the dash, windshield opening and front posts, the gun welder again comes into play

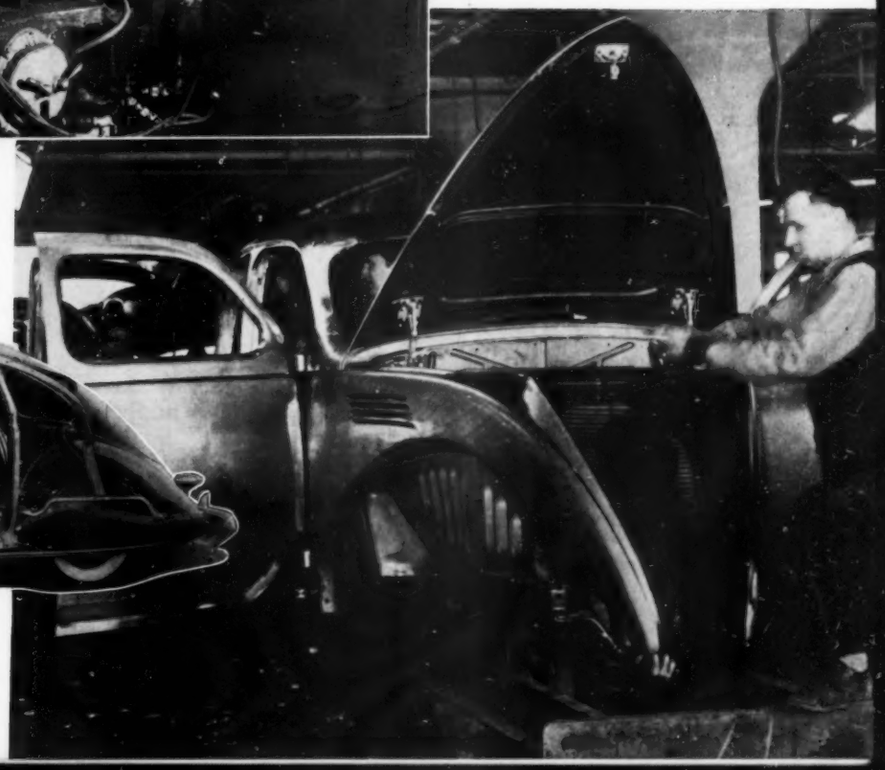
• *Below* — Sub-assemblies are finally fabricated in the main framing jig with its convenient electrical outlets

• *Lower left*—Frame and body are one, fabricated by 3,435 spot welds, 130 arc welds and 175 gas welds

• *Lower right* — With bodies carried on low trucks and propelled by a chain conveyor, the finishing touches are applied







HOPPER FEED POSITIONS A PART

A metallic garter clip can take six different positions but an ingenious mechanism confines it to one

CHARLES F. SMITH

ASSEMBLY of a garter fastener required its placement on the machine bed in only one of the six positions that it could take. The part was so small as to prevent satisfactory stacking by hand and dropping into a feed tube, and moreover the required production demanded a hopper feed. Here entered the fact that the peculiar shape would entail a rather unusual selective and positioning mechanism. Finally, to complicate matters still further, the exceeding cheapness of the piece made imperative a feed that would be absolutely positive to prevent loss of the operator's time.

These considerations can better be appreciated from reference to the work in Fig. 1. Here it will be seen that the part consists of a small thin plate with two elongated holes punched therein, and a knob, or button, staked to the plate with a pin. When positioned on the machine bed the knob must project downward and the longer dimension of the rectangular plate must be parallel with the front-to-back axis of the machine bed.

As said previously, the part can take any one of six positions. The first step was to provide some means whereby the mass of parts in the hopper could be selected so that the knobs would all point in one direction. The hopper *G*, Fig. 3, has a selector ring *H* with a series of pockets I milled in it. As shown by Fig. 2, these pockets are shaped so that the plate portion of the piece can enter only the thin channel provided for it, the knob channel being too narrow to permit entrance. No attempt is made at this point to position the plate with respect to its long or short axis. The opening for the plate is made wide enough, however, to accommodate the diagonal distance across the plate if it should happen to enter the chute cornerwise.

Since the assembling machine operates at high speed, the hopper must be provided with enough pockets to insure a continuous supply of parts. Were it not for two sets of pockets the hopper would be too large. A piece is taken alternately from the two sets of pockets by the chutes *J* and *K*. Intermittent drive to the hopper ring is provided by a cam-operated dial. As shown by Fig. 4, the two chutes have a tapering channel for the plate portion of the work. Thus, the plate may enter the chute cornerwise but is constrained by the tapering portion to right itself, but without regard to whether the long or short axis is horizontal. Both chutes curve outward and then inward so as to aid the part to fall into one or the other positions. Before the two channels reach the selector plate *M* in Fig. 3 they merge and therefore both discharge to the single selecting means. At this point it is necessary to align the long axis of the parts all in one direction; that is, parallel to the front-to-back axis of the machine bed. When a piece reaches the selector plate *M* it is stopped momentarily by the escapement finger *N*. If not in the proper position it drops through *M* into an auxiliary chute *P* below that turns it 90 deg., thus placing it in the correct position. Escapement finger *N'*, Fig.

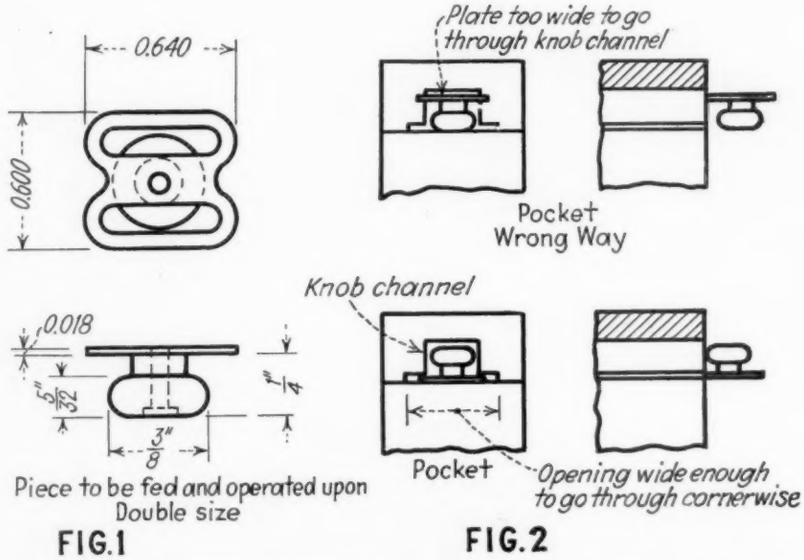


Fig. 1—The thin, small plate and the large knob complicate the mechanism of the feeding equipment by requiring several stages of selective positioning. Fig. 2—As the first step, the work is selected with the knobs all pointing one way

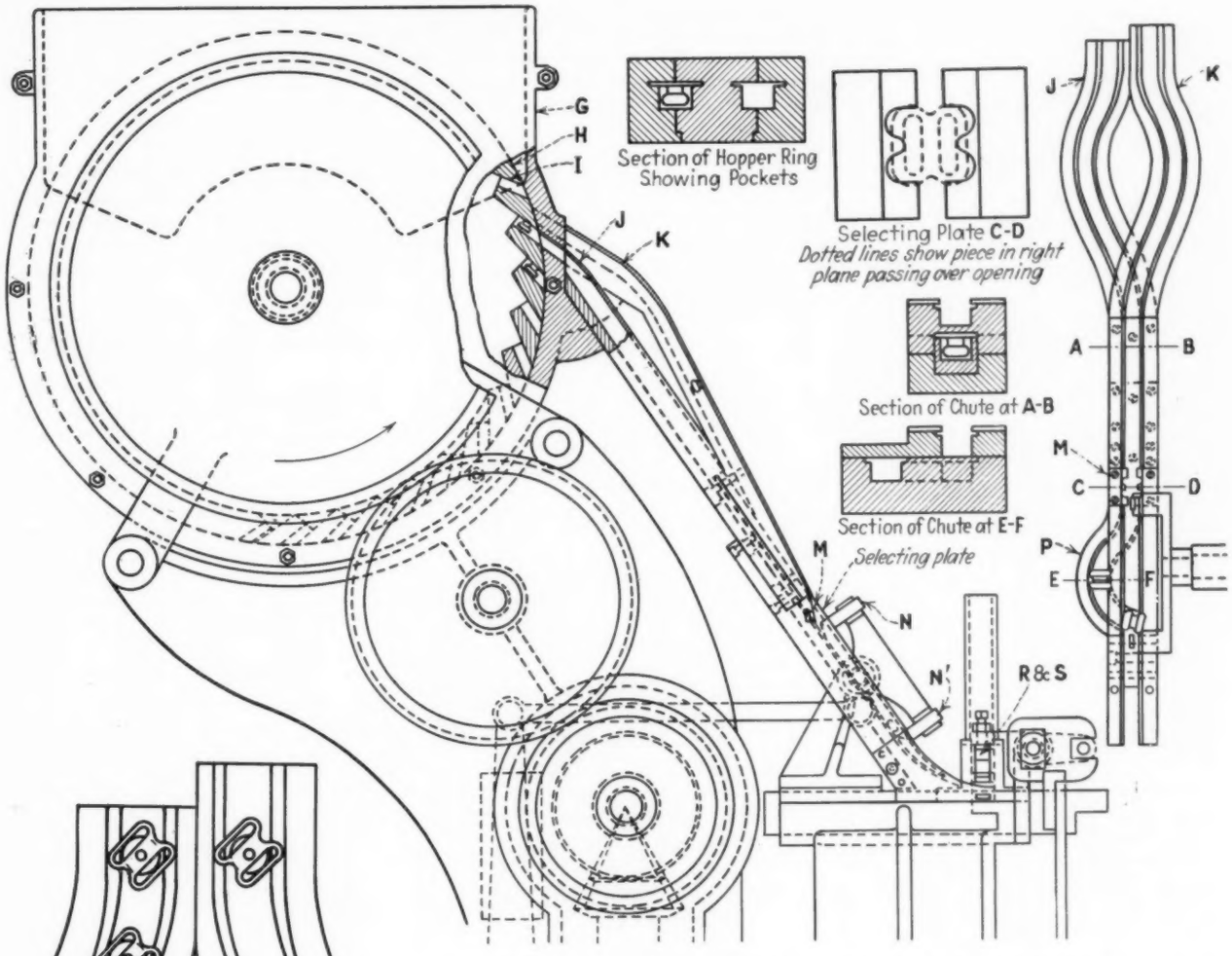


Fig. 3—Two chutes are needed because of the two sets of pockets I in the selector ring H. Selector plate M and auxiliary chute P correct the axial alignment of the plate portion of the work for such pieces as come down the chutes the wrong way

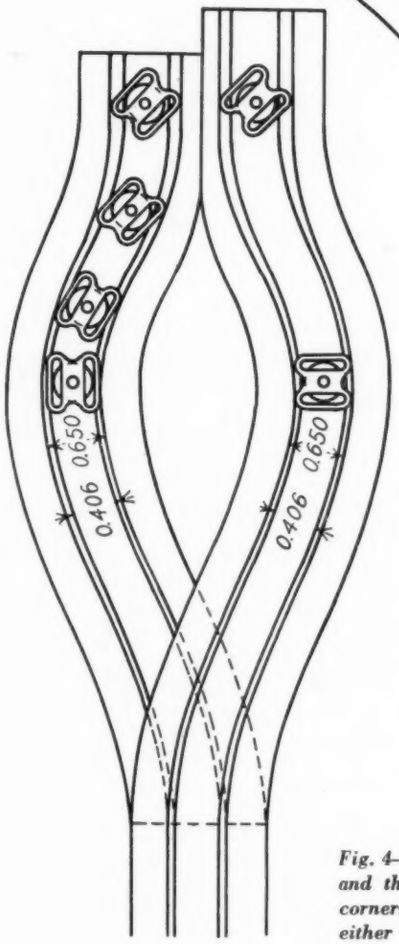


Fig. 4—The tapered mouths of the chutes and the curves aid the parts that enter cornerwise to assume a position with either the long or short axis vertical

5, catches the part and holds it until finger *N* moves down to catch the next piece coming down from the hopper. The piece held by finger *N'* is then released and drops into the chute carrying it to the final station.

On the other hand, should a piece come down the chute with the long axis vertical as required, it can not drop through the selector plate *M* as shown in section *C-D*, Fig. 3, but is held on top of *M* until finger *N* moves up and allows it to fall through the straight chute leading to the second finger *N'*. The purpose of this second escapement finger is to stop the work in the main through chute or in the auxiliary chute *P*, as the case may be, in order to prevent undue momentum of the work, and thus make the time of delivery more uniform. The two chutes merge at the final station.

It is unlikely that the hopper will fail to feed a piece, but in such an event a separate reservoir will supply one. Its action is to attempt to drop a piece into the final station at every stroke of the press. Two fingers *R* and *S* in Fig. 3, and shown in detail as at *C*, Fig. 6, control the pieces in the reservoir. At *A*, Fig. 6, the fingers are shown in the raised position and holding up the stack in the reservoir so that a piece in the delivery chute from the hopper feed can enter the final station. As the assembly cycle progresses the driving mechanism for the reservoir fingers causes them to open and drop the load on the piece just fed from the delivery chute. Thus,

Fig. 5—Escapement finger N stops the downcoming part momentarily over the selector plate M. Finger N' likewise holds the now correctly positioned part, which may lie in either the through chute or in the auxiliary chute, so that its delivery to the final station is correctly timed

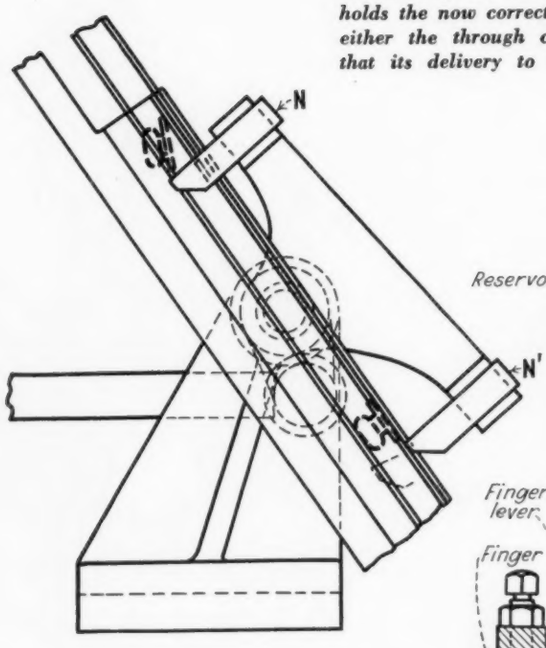
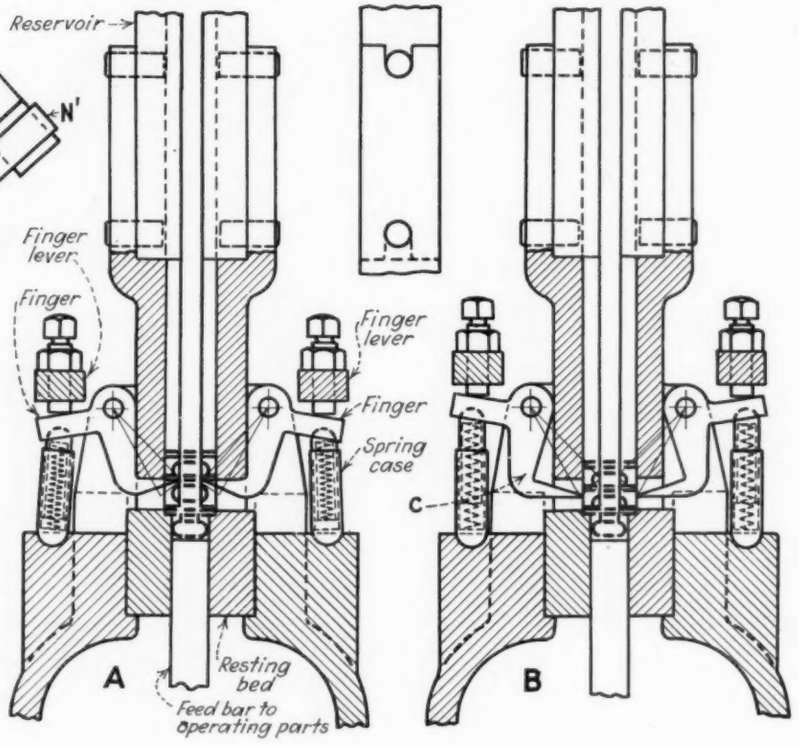


Fig. 6—Fingers at the reservoir lift the stack up as at A to allow a piece to enter the final station from the feed chute. These fingers open as at B to allow a reserve piece to drop into the final station if none is forthcoming from the feed chute



if no piece has been supplied by the magazine, one from the reservoir will make up the deficiency and there will be no interruption in the assembly process. When the fingers close in again they lift the stack in the reservoir so that another piece can pass under from the chute. The reservoir is loaded at the bench with about 100 parts. Two reservoirs are kept in reserve. These are sufficient for the working day.

Industry Needs Such Ideals

A. W. FORBES
Forbes & Myers

I have been talking with a boy, just an ordinary boy of ten, but what he said was significant. The shop door was open, and as no one told the boy to keep out, he naturally walked in. After he had examined the machinery for a time, we sat down together at one of the work benches.

He plans to be a farmer. His uncle has a farm, and he likes it. His younger brother, aged five, has decided to be a locomotive engineer. His next older brother, aged thirteen, is to be an electrician. And he has two older brothers (there still are some large families), aged eighteen and twenty, but they have not decided what to do. They have finished school and are now looking for any kind of job.

This is but one family, but is it not typical of the times? There are boys, plenty of them, interested in accomplishment, through any of the recognized kinds of adult work, ready and eager to have a part themselves. And then, a few years later, these same boys have become young men, their ambitions gone, seeking aimlessly for anything that will bring them a few dollars.

Childhood ideals change. We cannot expect that boy of five will keep his desire to be a locomotive engineer through life; but instead of change what we find is loss. Instead of a broadening and extension of the ideal, it has degenerated into aimlessness, or merely to a desire to get enough money to take a girl out for a night.

The employer who wants unskilled labor on routine jobs may be satisfied with the result. He finds plenty of young men from whom to select, young men who will be submissive as long as they get their weekly pay. But there are some of us who are not satisfied with that kind of employee. We want young men of ambition, who are interested in the simpler jobs of the factory, but who want to rise through them to better positions.

There is but one solution. We cannot rejuvenate the young men who have lost their ideals; we must seek ideals in the younger boys. And so I say that the one thing that will do more than any other to produce a superior class of workers, and through them a superior group of executives, is a drive to get boys when younger, to get them when their vocational ideals are still active, and then give them in industry the chance for development.

"Society owes no man a living. But society or industry cannot last long if it doesn't give men the opportunity to earn a living."—H. H. Kerr, president, Boston Gear Works.

Talking Shop

Toledo's peace plan brings a powerful force into the strike situation —the daily press. All three of the leading newspapers, through their editors, have got behind this move to adjust labor disputes before they get to the strike stage. They see that the whole city, including the newspapers, loses if industries shut down and men go off payrolls.

Flexibility in Special Machines

Flexibility and highly specialized functions have seldom gone together in machine tools or elsewhere. And yet this seems to have been accomplished in some of the newer machinery for automotive production. This flexibility, according to a recent traveler in

Europe, is responsible for large sales of specialized gear equipment to several automobile plants aboard. None of these plants have large production by our standards. But the increased flexibility that has been secured in the last few years enables change-overs to be made in from 12 to 20 minutes in a plant using the same gear finishing machines on eight different gears. The purchase of this new equipment is the result of a demand for more quiet gears in the low powered cars used where gear shifting is the driver's greatest exercise. This same flexibility makes the machines more adaptable for changes in model even in large production plants.

Labor is winning more of its arguments with employers as industrial activity grows. Which is not to be wondered at because that is what always has happened at this stage of the business cycle. In fact, it is about as good an indicator as one would want that business is on the upgrade.

Grinding Compounds Are Cleaned

Centrifugal separators for cleaning grinding compounds are being used in some of the larger plants. This results in a decided improvement in the finish of the work as the scratches caused by particles of dirt getting between the work and the wheel or steady rest are eliminated. More pieces are ground for each wheel dressing and the life of wheels is prolonged. Clarified lapping compounds also give a better lapped surface.

Movie Camera in the Shop

As with many new ideas, it has taken a long time to secure recognition of the value of the motion picture camera as a means of demonstrating, or of studying, machines and mechanisms. When it comes to instructing men and women to operate new machines, the motion picture is a real time saver. Seeing just how an operation

is performed, in slow-motion if necessary, gives confidence to the learner and should prevent both errors and spoiled work.

The designer himself can frequently get ideas from a study of his mechanism in operation in slow motion film. True, the stroboscope can be used for similar purposes, but the film has the advantage of being a permanent record that can be studied at any time. One maker has added a sound track so that any ideas or descriptions can be recorded, either at the time the picture is taken, or afterward.

Three cheers for the works manager whose hobby it is to teach every man in his plant two jobs so that he can be shifted around if work in his department gets slack. Practical result of it during the past year has been to keep men off relief.

Creep Strength

Heat affects steels in peculiar and disconcerting ways. They generally increase in strength above room temperature, but weaken above 750 F. Distortion and weakness against bending stress increases rather rapidly above this point. At 1,000 F. the so-called "creep strength" may be less than a quarter of that at the maximum. This is important to designers of machines for high temperature.

Stakhanov, young Russian mining engineer, finds out that he can increase production many times by planning continuous use of machine equipment. Endeavor to introduce his principle results in many fights and a couple of deaths, as might have been expected. The same thing has happened hundreds of times and will happen again.

The 2-Millionth Patent

If all inventors were as practical as Joseph Lędwinka who recently received the two-millionth patent issued by the U. S. Patent Office, the patent records would show a much cleaner record for sanity than is now the case. Instead of impracticable car couplers, lock nuts and egg-daters we would have fewer patents but more of them would be of real service.

He began with an electrically propelled vehicle in 1899; his last patent, and the 248th issued to him, is for im-

proved pneumatic tires for railway cars. In between came the all-steel automobile body and the light weight, stainless steel streamlined trains of the Budd Company. And not a single perpetual motion machine in the lot. That's some record for any inventor!

—The Editors.

LONGER LIFE
for GALVANIZING FURNACES

WALLACE G. IMHOFF
President, The Wallace G. Imhoff Company

IT IS pertinent to ask, "What part does the master mechanic have in the successful operation of the galvanizing furnace?" To answer this question it is necessary to explain what the successful operation of a galvanizing furnace is, and also the relation of the master mechanic to the galvanizing department.

The successful operation of a galvanizing furnace depends upon furnace design and construction, ease of operation, the dross it makes, life of the galvanizing pot, and finally the production put through the pot in a given time. To give a better perspective, it might be explained that in some cases the galvanizing furnace has been designed by the plant engineer, in other cases it comes under the duties of the master mechanic, while in still others it is in entire charge of the galvanizing foreman.

In very large corporations, the galvanizing furnace is designed by the engineering department; in very small plants it may be designed and constructed by the plant brick-layer. The maintenance of the furnace most always is done by the plant master mechanic.

THERE are three distinct angles to successful galvanizing furnace operation; namely, combustion engineering problems, galvanizing engineering problems and mechanical engineering problems. It is not an exaggeration to say that combustion engineering of galvanizing furnaces is one of the most difficult of all industrial heating problems. This is because there are so many forces of destruction. It may be destroyed from the inside, or it may be destroyed on the outside, or the mechanical equipment may pound it to pieces. Few pieces of equipment are subjected to such a large number of destructive forces.

Still another agent of destruction is chemical action due to the attack of the sal-ammoniac and other materials used in the galvanizing process.

Many skilled combustion engineers have interested themselves in the combustion engineering of hot-dip galvanizing furnaces. Up to the present the solution has been so baffling that no one has given the final answer. Little wonder that the ordinary master

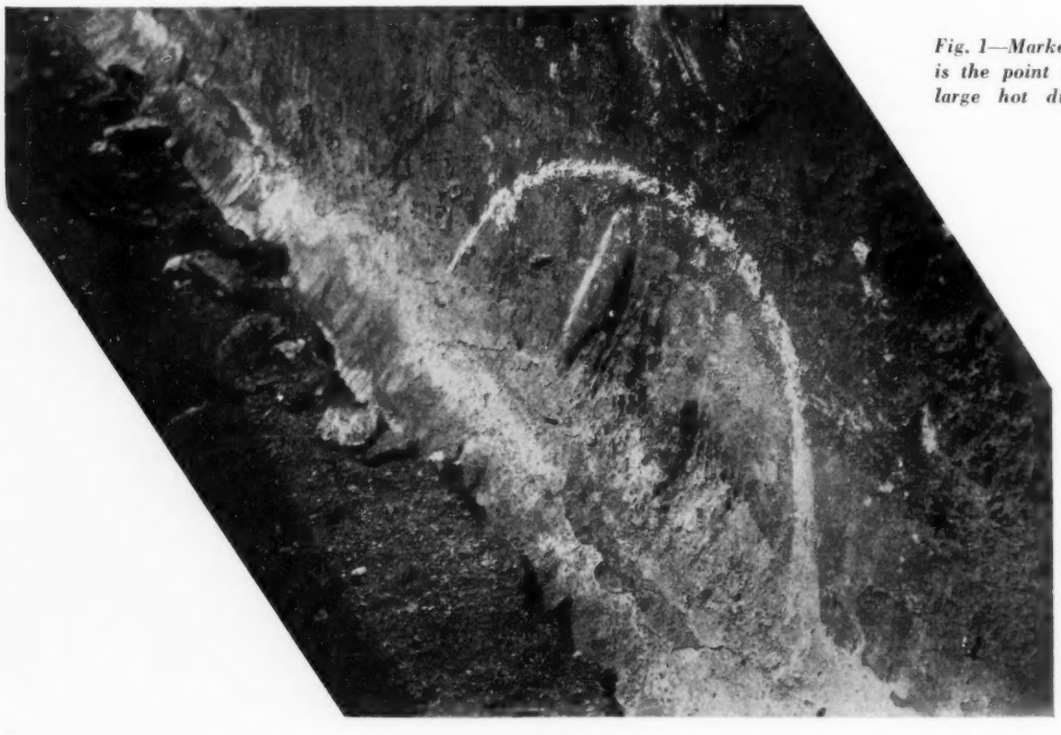


Fig. 1—Marked by the chalk line is the point of destruction of a large hot dip galvanizing pot

An understanding of the destructive forces present will add useful hours to hot-dip equipment

mechanic has found some of his most annoying troubles in the galvanizing department.

While it is not the duty of the master mechanic to change the design of the furnace, still it is important that he should know and understand the problems of combustion so that he may render better service in his own field of duty. In some cases the construction of the furnace is such that, insofar as combustion engineering is concerned, about all the master mechanic can do is to keep the furnace in a good state of repair at all times. A galvanizing furnace is not like any other furnace. Corrosion from the action of the molten zinc is always going on upon the inside, chemical destruction of the brickwork and the top of the furnace is always going on upon the outside, intense heat may be destroying the combustion chambers by melting the brick, and machines operating on the top of the furnace may be hammering it to pieces.

The problems of combustion engineering deal mainly with keeping the furnace combustion chambers in a good state of repair so that the heat will be properly distributed and will not warp and destroy the furnace setting. With oil fuel, the burners must be kept clean, and the combustion chambers in a good state of repair; with gas the same applies; with coal the grates must be kept new and the flues open; with coke the combustion chambers and setting must be kept in a good state of repair.

All of these points seem so self-evident that one perhaps wonders why they are mentioned; yet in practice it is surprising to see the bad state of repair that some furnaces get to before anything is done about it. In no field of engineering is it so important to make repairs once they are needed as with galvanizing furnaces. The forces of destruction are so active and so persistent, that if repairs are not made just as soon as possible, it is not long before a shutdown results and major repairs must be made. Repair work is most always the duty of the master mechanic, so from his own selfish standpoint it is to his advantage to make the repairs before they accumulate.

Fig. 2—Magnified 36 diameters ordinary galvanizer's dross has this appearance

IN CONSIDERING the galvanizing engineering of such a furnace, there are some facts that the master mechanic should know in order to appreciate the hardship that the galvanizing foreman is laboring under. The galvanizing foreman is being pushed all the time to get out the greatest production possible; in doing so he may aggravate any combustion engineering trouble, which in turn is his own boomerang in that forcing production under such conditions may greatly multiply the quantity of by-products made, while at the same time destruction of his furnace continues at a rapid rate.

Fig. 1 illustrates the failure of a large galvanizing pot while in service at a high rate of production. A chalk line is drawn around the hole in the side. Pot destruction is a problem of both combustion engineering and galvanizing engineering; they are twins in their work of destruction, one helping and aggravating the other.

The first thing that happens is the formation of a zinc-iron alloy known as galvanizer's dross. This material forms very slowly at 800 F. At 860 F., it becomes active enough for anyone who is a close observer of practical things to see that the molten zinc is forming this by-product. From 869 F. the swing in the curve for this alloying action slowly rises. At about 885 F. the curve takes a sharp turn and from 885 to 950 F. the curve swings almost straight up.

To appreciate now what happens to the galvanizing pot attention is directed to Fig. 2 which illustrates some ordinary galvanizer's dross as seen under the microscope. Two components are at once recognized; the white area which is the galvanizing bath, and the dark crystals which are called dross crystals. These dross crystals are greatly affected by the temperature of the bath, the iron available, and the zinc. The point of interest here is to explain what happens when the galvanizing pot is destroyed.

Once the dross, or zinc-iron alloy, starts to form it settles like snow to the bottom of the galvanizing bath, and like snow it has the property of packing tighter and tighter. The force which causes galvanizer's dross to pack tighter is heat accumulation. As the dross contains about three to four per cent iron it accumulates heat due to this iron content. When it becomes hotter it does what the galvanizer calls "sweat," that is, there it appears that the molten zinc between the crystals is coming to the top of the bath, while the dross is packing tighter. As the dross packs tighter it naturally acquires more heat, and this higher temperature makes dross faster; so it goes on in a vicious circle, first heat, then dross, then packing of the dross, then more heat, then more dross, then still tighter packing of the dross.

As the temperature gets higher and higher, however, the forces of destruction become much more active. The zinc slowly attacks the side of the galvanizing pot at temperatures below 850 F. I made a survey of one case,

where the temperature at the top of the galvanizing bath was 850 F., but the temperature down in the bottom in the dross was about 1,300 F. Needless to say that, under those conditions, the pot would not last long. This description brings out clearly why a galvanizing pot should be drossed often; and the dross should never be allowed to accumulate for any length of time.

WHILE on the subject of dross, it is interesting to tell of another case where the galvanizing pot was worked only at one end. It was a very large pot, and when business was good it had been worked at both ends. The management was somewhat startled when one day someone poked a rod down in the idle side of the galvanizing pot. They were amazed when they found the entire galvanizing pot on that end completely filled with dross up to within about 1 in. of the surface of the galvanizing bath. Little wonder that two of them failed in one week.

The third feature of destruction with the ordinary galvanizing pot is the chemical action of the sal-ammoniac flux on the pot and on the brickwork of the furnace. Sal-ammoniac contains muriatic acid under the conditions that it is used for fluxing in galvanizing; hence, if this hot, slag-like material is allowed to run down into the combustion chambers or in between the pot and the brickwork, the action of the acid is likely to destroy the pot by chemical action. More than one galvanizing pot has failed because this flux was allowed to run down into the brickwork.

Examples have been seen where the hottest application of the heat was at the top of the pot. It is in such cases as this that the action of uncontrolled flux may do the greatest damage. The acid aggravated by the intense heat causes much more rapid attack than when the region of greatest heat application is at the middle of the pot, and the top of the furnace is colder.

The fourth factor of destruction which comes directly under the supervision of the master mechanic is the pounding action and jarring caused by operation of various machines placed on the top of the furnace, or in the pot, to increase production.

When possible the pounding of such machines should be taken care of by steel piers, or bracing, that extend to the foundation independent of the furnace. It is only by such means that this hammering and pounding can be kept from finally wrecking the furnace setting. Many examples can be found where furnaces are destroyed because these forces of destruction are not known, and their action, which in most cases is slow, is not checked. The final day of reckoning always arrives.

Dimensions for Press Tools

C. W. Hinman

Important dimensions of press tools are the length and breadth, or area, and the thickness of the die-shoe and the punch holder; the diameter and length of the punch shank; the closed height of the tools from the top of the punch holder to the bottom of the die-shoe, and the over-all length of the leader pins; the length, breadth and thickness of the die-block, stripper plates, spring pads and punch plates; the length of the punch and the sizes of the punch and the die contours. These latter should be shown in a separate detail, although they may be given in the plan view of the die, which should be the upper part of the tool drawing. In the case of an inverted die, the dimensions for the punch outline can be shown in this view.

The diameter and the location of the leader pins are not shown in commercial die-sets, but it is necessary to show to scale where these pins are located to avoid possible interference with the work. If the die is special, all the dimensions pertaining to it should be given. In large die-sets having no punch shanks, it is common practice to locate holes in the punch holders, corresponding with the tapped holes in the ram face for securing them to the ram. A flange base should be dimensioned all around the die-shoe, if very large, or at both ends if it is small. This flange is for securing the die-shoe to the bolster, either with bolts through the flange or with clamps on the flange itself.

Leader pins and the holes for them, including the holes for the wear bushings, should be dimensioned in both the upper and the lower parts of the die-set. The letters P. F. or S. F. should be placed near these dimensions, indicating a press fit or a sliding fit as needed. If the leader pins are two and are in the center of the ends of the die-set, or if they are four, one at each corner, one pin and its bushing should be smaller in diameter to prevent the punch holder from being assembled in the wrong position.

Dimensions that locate the same surfaces should not be repeated in other views because one dimension may be changed later, while the others may be overlooked. Considerable trouble in tool construction has arisen from such an error.

Most tool designing offices issue a book of standards in which all types of die-sets and standard attachments are given. These include the method for dimensioning, also punch press dimensions and capacities, together with tolerance allowances for the working dimensions of tools. The general rule for giving dimensions that affect the product from the tools is a tolerance of plus or minus 0.005 in. on common fractional dimensions, and plus or minus 0.001 in. on all decimal dimensions, unless otherwise specified.

Close tolerances are difficult to reach and maintain, and are therefore expensive. They should never be specified unless absolutely necessary. Allowable limits should be as large as practically possible. It is well to question the tolerances specified by the engineering department, especially when such tolerances affect the cost of toolmaking. There are cases in engineering practice where limits of plus 0.0005 and minus 0.000 in. have been specified, when plus or minus 0.002 in. would have served just as well. Most designers use too many limited dimensions where not required, simply to play safe. It is best to ascertain the correct tolerances, even at the expense of time, rather than to continue this expensive guessing.

Tolerances of omission may easily cost more than those of commission, later in the assembly department. This fact should draw attention to the importance of making a more thorough investigation before either using or omitting tolerances promiscuously.

Steel Socks

Enterprising Sheffield steel makers are finding new uses for stainless, according to *Industrial Britain*, one of the most unusual being for clothing. Fashion's latest note is stainless steel ties and socks. Another application is for bath tubs on liners. Saving in weight over enameled cast iron and other usual mediums is an item of importance.

Editorials

AMERICAN MACHINIST ESTABLISHED 1877
VOLUME 80 NUMBER 1
K. H. CONDIT • F. H. COLVIN
EDITORS

ECONOMIC SECURITY

BEGINNING today business starts the payment of a new series of taxes under the Social Security Act. Unemployment insurance is no longer a debatable theory. It is a fact. Collections for old age pensions commence a year hence.

From the point of view of the working man, particularly if he has dependents, loss of his job is a deadly fear. Until he recovers from the shell shock of the depression this fear is likely to outweigh the desire for opportunities to advance which has made what we like to call the American system.

Politically, the passage of the Social Security Act, with all its faults, was a wise move in that it headed off, for the time being, such impossible schemes as those of Huey Long and Dr. Townsend. The problem yet to be solved by the statesmen is how to provide security without sacrificing all opportunity.

Employers generally have been skeptical of the workability of the Social Security Act as passed. Most of them recognize clearly enough the need for some measure of security for their men, and a few of them have set up pension and unemployment insurance programs for their employees that go far beyond the federal law. Whether or not they like the existing law is beside the question. The law is on the statute books and it will stay there, because no Congress will ever vote to repeal a measure that involves intimately so many voters.

But the employer has to carry on his business at a profit if the business is to exist. The Social Security Act increases the cost of doing business by the amount of the tax on the payroll, one per cent now, six per cent later. How can this added cost be offset?

For the manufacturer there is one sure way—modernization of his equipment. For the present, and for some years to come, costs can be cut by substituting more efficient machinery for the antiques that have been kept in use through force of circumstances.

In the future, after modernization is complete (if that ever happens) further mechanization of processes will be in order. There is no alternative. Economic security of the company is quite as vital as social security of the worker, so long as we continue to operate on a capitalistic basis.

Volume 80

AMERICAN MACHINIST will be fifty-nine years old this year. Started in 1877 by Horace B. Miller, with Jackson Bailey as the first editor, it has been edited in turn by Frank F. Hemenway, Fred J. Miller, Frederick A. Halsey, Leon P. Alford, John VanDeventer and Ethan Viall. We note with regret the passing of Mr. Halsey on October 20th last.

The new volume, Number 80, will be edited by Kenneth H. Condit and Fred H. Colvin, editors; John Haydock, managing editor; Burnham Finney, western editor (Detroit); S. Ashton Hand, associate editor; H. R. Le Grand, assistant editor; Paul Wooton (Washington); Leonard Church (Cleveland).

Equipment Comes First

WE HAVE just seen one well-managed plant where the general superintendent emphasizes the necessity for keeping the toolroom as small as is consistent with tool maintenance. All new tools and special fixtures are secured from shops that specialize in work of that kind, partly because they are cheaper, but also because the building up of excess machine inventory and personnel is avoided.

This toolroom is not neglected, however, when it comes to equipment. The best machines available are purchased as soon as it can be shown that they are a good investment. While this may be called expansion, insofar as the new machines are more productive than the old, it is much more desirable in every way than to add to plant area before that becomes actually necessary.

Chips

WASHINGTON — First inkling of federal budget given as Roosevelt says at press conference he will ask for not more than $500,000,000 for PWA, and Hopkins remarks that new applications for relief are coming in so fast that a dole will probably be necessary . . . Head of American Legion presents first bonus demand to the President . . . Army places order for 100 attack planes, over 100 heavy bombers . . . State Department working with several senators on new neutrality bill . . . Ickes gets behind Wagner program for low-cost housing involving $800,000,000 . . . Treasury issues rules for procedure in reporting for unemployment insurance taxes . . . Roper spoils picture of gloom painted by Berry by reporting steady business gains in 1935 and calling it second year of recovery . . . President says he made no promise to take care of employables indefinitely . . . His 3,500,000 estimate differs widely from nine or eleven millions mentioned by various labor chieftains . . . NRA ends January 1 by executive order.

FOREIGN — Ethiopian attack drives back Italians 20 miles on the northern front . . . Anglo-French peace plan is turned down at Geneva . . . Leads to sudden resignation of Hoare, British foreign minister, his replacement by Anthony Eden, and almost upsets Laval government in France . . . Ethiopia will have none of it . . . Benes succeeds 85-year old Mazaryck as president of Czechoslovakia . . . Airplane building race in Europe is reported by British experts . . . Naval conference adjourns for the holidays with nothing decided . . . Japan protests Soviets' "warlike" moves in Siberia . . . Modernization of British army is begun . . . French and British military chiefs meet to consult on mutual defense measures if Mussolini attacks.

FINANCE—Silver prices continue down in London . . . Income tax payments rise . . . President of Bankers' Association tells Roosevelt banks are ready to resume normal lending . . . 15 railroads report rise of operating net in November of 65 per cent.

INDUSTRY—Labor Board studies Consumers' Research strike . . . Motor Products strikers try to unite rival unions as production continues . . . Secretary Perkins urges passage of Walsh bill to force NRA standards on government contractors . . . Standard Oil of N. J. will supplement federal pension plan for its employees . . . Over 200 salaried employees of Mesta Machine Co. get an average of $500 apiece in bonuses, shop men got theirs in bonus and overtime during year . . . Many other companies restore old Christmas bonus policies . . . General Motors distributes $5,000,000 to 200,000 employees . . . Kansas City judge decides Wagner Industrial Disputes Act is "flagrantly unconstitutional" . . . Bethlehem Steel consolidates three operating units, McClintic-Marshall, Pacific Coast and Kalman Steel . . . Labor Board threatens complaint against Pratt & Whitney Aircraft and Hamilton Standard Propeller.

TRADE—Department store holiday trade rises 10 per cent . . . Trade treaty with Holland signed in Washington . . . Treaty with Spain to follow shortly.

INDICATORS—Holidays drive steel production down several points but strong recovery is expected in January . . . Electric power output continues high . . . *Business Week's* index at 75.2, up half a point.

Watching Washington

Vote-seeking congressmen may shatter short session hopes . . . Major Berry asks for an encore . . . Early action slated for bonus bills . . . Migration seen as small shop salvation

WASHINGTON—New Year happiness is dimmed only by the thought that in two days Congress will be with us again. Business is not particularly glad to see it back—in fact it would be pleased to have the legislators skip a session.

From the President's expressed views for a short and snappy Congressional program, it is evident that he doesn't consider full House and Senate chambers great assets during a major election year. April adjournment would certainly receive Executive blessing.

Who, then, will prolong a session that is unwanted by the President, by business and by most of the citizens? Nobody but the senators and representatives themselves, activated by that greatest of human urges, self-preservation. In the face of determined men fighting for their political lives, hopes for a short session will vanish. It will stretch to the crash of the gavel in Cleveland which will call Republican hopefuls to order next June, just two weeks before the big Roosevelt ratification.

Another element, which may cause even the Administration to change its mind on Congressional brevity, is the list of court decisions which will be made in the next few months. The President appears willing to rest largely on the legislative progress made during the past three years and to await rounding out his social program until his second term, toward which he looks with confidence. "Musts" have been reduced to a scant handful including only appropriation bills, work relief, neutrality legislation and other matters of lesser importance. But a tumbling by the courts of the house of cards built so painstakingly during the past three years might materially alter this viewpoint. Symptomatic of what may happen is the forthright ruling by Federal Judge Merrill E. Otis who declared that, in passing the Wagner Bill, Congress had exceeded its constitutional right "to regulate commerce with foreign nations and among the several states. . . ."

Post-holiday events in Washington include a second party by Major George Berry on January 9. Undismayed by the spectacular fizzle of his first gathering the forgiving Major has invited many industrialists who responded to his first R.S.V.P. with an emphatic negative.

No one can quite understand the persistent efforts to breathe some new life into the industrial conference plan. Cooperation by business management is an essential; when that was not forthcoming the whole conception fell flat. Nevertheless Major Berry, after conferring with the President, proceeded to call a meeting of the "council" just as though representative delegates of industry had participated.

NRA's belated demise occurred yesterday as a result of a Presidential decree which divided the remains of this erstwhile instrument for industrial control between the Departments of Commerce and Labor. Of the personnel 600 have been dropped and the balance of 1,400 will continue to April 1 when the NRA extension act expires. Perhaps Berry's "council" efforts are being made to convince organized labor that, with the dismemberment of NRA, the Administration has not entirely discarded its former grandiloquent plans for industrial control.

Before the Patman bill, providing for the payment of bonus certificates with greenbacks is taken up January 13, the Ways and Means Committee will have reported a bill of its own. This probably will provide for the payment of the 1945 value of the certificate in bonds.

Some of those who oppose full payment will advocate the issuance of a savings bond which would have to be held until 1945 if the veteran would receive the full amount of his certificate. If cashed earlier he would receive only the actual value of the certificate on that day. The majority of the committee is expected to oppose any such plan.

While the majority of the committee is perfectly willing to vote the extra bonus that goes with payment of the full value it would like to delay actual payment until September or October so the maximum effect of the distribution would be felt at the most opportune time, just before election.

Representative Vinson, of Georgia, author of the bill providing for the payment of the bonus in bonds, which was voted on at the last session, is revising his bill, but the Treasury has declined to assist him in the effort. The legislative committee of the American Legion has also drafted a bill.

Transplanting vs. Toboggan

Small industrial plants going broke in big cities may be interested in the plan again on foot in Washington to transplant them to small towns that are also on the toboggan. A sequel to previous fillips toward decentralization of industry, the present plan does not pretend to be more than an attempt to strike an economic balance of two factors that are a drag on the long hard pull back to prosperity.

There are, or were, to be accurate, 210,000 manufacturing plants in this country with an annual production of more than $5,000; 68 per cent of them had a volume of less than $100,000 in 1929. It was sink or swim during the depression, and 68,000 of them sank. Many located in large cities, are still struggling to support twelve months of overhead on short production schedules.

There are 121,000 small towns of less than 10,000 population. Since most of their customers drove away in automobiles these small trading centers have had tough going. Most of them never had an industrial payroll and today 100,000 of them, more or less, are on relief. These are the facts which convince William A. Julian, Cincinnati shoemaker, now Treasurer of the United States, Milford D. Burrows, WPA industrial engineer, and a group of industrial executives, that by moving to the country many small plants with a low intermittent payroll would save not only themselves but the small towns and benefit business generally by bringing 27 per cent of the nation's population that live in them back into the market.

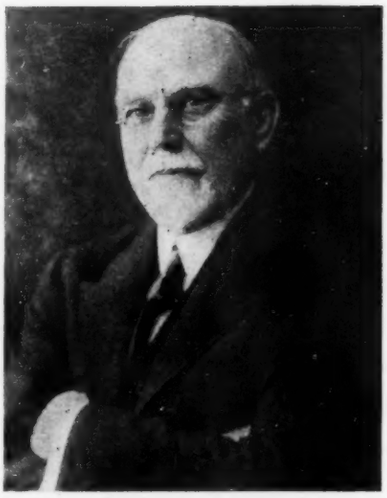
James H. McGraw Resigns As McGraw-Hill Chairman

Becomes Honorary Chairman

At a meeting of the Board of Directors of the McGraw-Hill Publishing Company, Inc., held on December 27th, 1935, James H. McGraw, the founder of the Company and its head for more than 50 years, resigned as Chairman of the Board and was elected Honorary Chairman. He will remain as a member of the Board.

James H. McGraw, Jr., who has been connected with the Company for the past twenty years, was elected Chairman of the Board. He has served as Treasurer and was Executive Vice-President and Vice-Chairman of the Board at the time of his election.

Malcolm Muir, President of the Company since 1928, continues in that capacity.



JAMES H. McGRAW

Soviet 1935 Purchases Reach Large Amount

During the first eleven months of 1935 the Soviet Union purchased in the United States goods valued at $36,500,000, of which $28,000,000 was spent for machinery, parts and allied materials. Most of the equipment business was placed between July and November, inclusive, in the amount of $20,000,000. In the six-year period, 1929-1934, inclusive, Soviet purchases have totaled $250,000,000.

Orders Drop Sharply for Foundry Equipment

Net orders for foundry equipment, compiled from reports of 23 member firms by the Foundry Equipment Manufacturer's Association, showed a sharp decline in November. The index, which is based on the 1922-24 level of activity, was reported as 99.8 for the month, whereas it had been at 140.0 a month earlier. A year ago, however, the November index was only 80.4. Shipments were better during the month, being 145.2, as against 119.7 in October. Reflecting the loss in orders and the gain in shipments, the backlog of unfilled orders fell to 119.2 from 164.7. The three-months' moving average of gross orders was 122.9 for November and 127.1 for October.

How Motor Industry Is Aiding Recovery

An abstract from "Preliminary Facts and Figures of the Automobile Industry During 1935" by Alfred Reeves, vice-president, Automobile Manufacturers Association, New York.

Production and Value	
Cars and trucks produced in U. S. and Canada	4,150,000
Passenger cars	3,400,000
Motor trucks	750,000
Production, percentage increase over 1934	45
Wholesale value of cars	$1,797,800,000
Wholesale value of trucks	$388,700,000
Wholesale value of parts and accessories for replacements, and service equipment	$565,000,000
Motor vehicles, accessories, service equipment and replacements of parts and tires	$2,999,500,000
Registration	
Motor vehicles registered in U. S.	26,000,000
Motor cars	22,450,000
Motor trucks	3,550,000
Per cent of world's automobiles in U. S.	71
Taxes	
Total motor vehicle user taxes	$1,288,000,000
Gasoline taxes, federal, state and municipal	804,500,000
Percentage motor user taxes to all taxes from all sources, federal, state and local	13

Industrial Review

• WITHOUT EXCEPTION machinery distributors in the important industrial centers of the country look forward to 1936 as a year when business will be larger in volume than it was in 1935 and when profits will be far more numerous. The last quarter of 1935 was better than most of the men in the machinery industry had expected and orders taken in December set high records for the year for several companies.

• BOSTON DISTRIBUTORS say that December business was good and that they expect to have trouble filling orders that are likely to come in during the next quarter. The Metropolitan district is in much the same position. Philadelphia is as conservative as ever but the trade there is confident of a steady and appreciable improvement in machinery and machine tool business. The burden of obsolete equipment in the Pittsburgh district when coupled with the load of the new social taxes is sure to force extensive modernization programs in metal-working plants there.

• EVERY INDICATOR in Cleveland points to better business for 1936 and that means improvement for the machinery builders and distributors. Prospects for 1936 are excellent in Detroit. At the moment there is a slight slowing down in orders but the tool and die plants are beginning to get busy and the supply business is decidedly active. Toledo is more optimistic than it has been in a long time. Cincinnati is optimistic over the possibility of sales during the first quarter.

• THE TERRITORY served by Indianapolis expects to wipe out all red figures in its 1936 ledger. Orders have been fair during the past month and inquiries are better than that. St. Louis reports that the only dark spot in its picture is the section of the industry that serves railroads. Chicago business has continued active right through the third quarter and the volume of inquiries on hand augurs well for better business during the first quarter of the new year. Milwaukee business has not been so active during the last few weeks but there is every reason to expect a strong upturn during the weeks ahead. The dearth of skilled machinists is beginning to be felt on the West Coast.

Used-Car Freeze-Up Slows Down Machinery Orders from Car Makers

DETROIT—December's indicated output of close to 400,000 units will bring production for the calendar year of 1935 to 4,150,000 units, surpassing last year by 45 per cent and all years back to 1929. The last quarter of this year will account for 1,000,000 cars, or about 25 per cent of the year's total as compared with an average of 18.7 per cent for the years 1920-1933. To date, some decrease in January and February is evident in the schedules, but no drastic change.

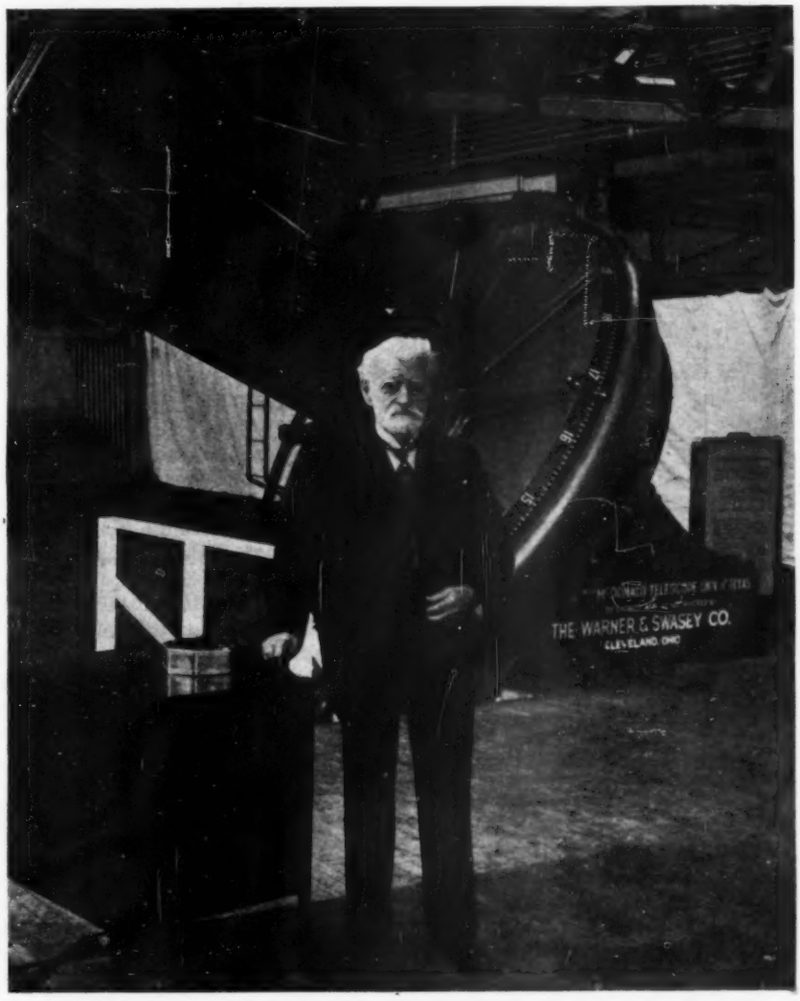
Used cars are not moving as fast as new ones. It is estimated that 3½ used cars are eventually turned over for each new car sold. In this area a two-months stock is available and excessive allowances are reported. This pile-up of used cars is credited with causing a delay in go-ahead orders for a large volume of equipment and extension orders on tap in several companies. At present attempts are being made in some quarters to control excessive allowances through banking credit policies.

Chevrolet has, however, through national advertising of the red tag on reconditioned cars carrying the same guarantee as a new car, made a remarkable success of moving used cars in dealer hands. During the first ten days of December, 35,000 such cars were sold and, since three and one-half times the first ten days figure is the average for the month, no trouble is anticipated in turning over the 120,000 used cars on hand.

Social security contributions begin January 1, with a tax of 1 per cent on payroll. Despite the fact that details have not been completely worked out by the government, manufacturers are being importuned to buy "services" in the nature of forms and procedures; keeping the payroll up to date is the only requirement. The motor industry is keenly aware that low prices are basic to volume distribution. Alfred P. Sloan, Jr., of General Motors, has consistently emphasized the point for the past two years and the slightly lowered level of '36 model prices despite increased costs is evidence enough that low price is the working policy of the industry. The answer to the 1 per cent levy will be a drive for lower manufacturing costs. That this will be the answer of the industry is shown in the marked increase in equipment inquiries within the past few weeks.

In answer to the contention that the capacity of tool and die shops in this area is insufficient to provide for the requirements of its customers, it may be pointed out that aside from the strike two years ago, customers have not been held up. This is despite the fact that all of them brought out new models at about the same time. Furthermore, in 1934, only 50 per cent of the capacity of member shops of the Automotive Tool & Die Manufacturers Association was used. The larger shops making heavy body dies are at present at a low level of activity. Some of the smaller shops are engaged in making duplicate dies for body hardware companies which are increasing capacity.

Experimental work is not in evidence in any volume at present. Engineering departments are reported hard at work on the '37 version of the automobile. The Lincoln-Zephyr innovations in design and construction are anticipated to affect considerably the remainder of the industry. This will throw a large volume of business in tools and dies into this area in the coming months unless the wish is father to the thought. The current low level of employment in the tool and die industry is further sup-



A *"Birthday Present"*—Ambrose Swasey appears in the best of health as he stands before the 82-in. reflector telescope "presented" to him by the Warner & Swasey Co. on the occasion of his 89th birthday, Dec. 19. A large gathering of scientists and manufacturers from all parts of the country, as well as many prominent Clevelanders, attended a luncheon in honor of the veteran turret-lathe manufacturer and telescope builder at the company's plant. The telescope has just been completed for the McDonald Observatory in Western Texas.

porting evidence of the contention frequently made that seasonal employment among this highly skilled class is a sore spot in the industry which the November introduction did not help.

The Fisher Body Corp. will shortly after January 1 begin the construction of a die and stamping plant in Grand Rapids, to be known as the Grand Rapids Stamping Co. This plant will serve as a central location for General Motors units and will produce 2,000 complete sets of stampings per day. In addition, the die capacity of the Detroit Fisher Die plant will be duplicated. This development will carry forward the policy of flexibility or duplication of the same manufacturing capacity inaugurated in the case of transmissions after the Toledo strike. This will call for an investment of $7,000,000, swelling the total invested by the corporation to between $60,000,000 and $70,000,000 for the year.

Inquiries for machinery is reported at the highest level for the year. Buying in other parts of the country led to pressure being placed on dealers in the area to secure automotive orders before machinery factories become filled with these outside orders. It is known that some six companies have sizeable programs lined up to buy but which are delayed due to the used-car market, uncertainty as to labor and uncertainty as to new car sales in the first quarter. Equipment purchases for a low-priced six as a companion car for a medium and high-priced line is in the cards. The Fisher expansion in Grand Rapids will call for large numbers of heavy presses. Evident also are inquiries for toolroom equipment, notably Pontiac.

Labor Groups Squabble

The merger meeting held December 21 to consolidate three independent labor groups, the M.E.S.A., the Automotive Industrial Workers Association and the Associated Automobile Workers, was handicapped by the withdrawal of the Automotive Industrial Workers Union. Jockeying between Father Coughlin, R. T. Frankensteen, Mathew Smith, A. E. Greer, and F. J. Dillon for dominant position is further complicated by the efforts of Lewis, of the United Mine Workers, to absorb the A. F. of L. Automotive Union.

The National Labor Relations Board, in the first cease and desist ruling in the automotive industry, has ordered the Freuhauf Trailer Co. to reinstate seven discharged men, to pay back pay, to cease using detectives to spy on union activities and not to interfere with organization of workers. Suit is to be filed by the company in the Cincinnati court of appeals.

JOHN W. O'LEARY

Sees Need for Private Investment During 1936

Revival of courage and of confidence in the future have been responsible for wholesome gains in the capital goods industries during the latter half of 1935, according to John W. O'Leary, president of the Machinery & Allied Products Institute. Spectacular gains in industrial recovery during 1935 were made in certain of the machinery industries, particularly in machine tool manufacture. These gains should continue in those industries in 1936 while substantial improvement will also be enjoyed in other machinery and capital goods lines. It must be remembered that capital goods industries require a 300 to 400 per cent improvement over depression lows before they reach the 1929 level, whereas consumer goods industries have already recovered practically all of their much smaller decline. The gains made therefore are proportionately small; the potentialities ahead are large.

A major factor which will determine the progress of capital goods industries in 1936 is the extent to which risk bearing capital ventures into new investments. Business itself—the corporations which manufacture or process commodities—offers the chief market for heavy machinery and similar capital goods. Sales of capital goods are dependent upon replacement of obsolete or worn-out equipment and upon business expansion. Purchases of this kind are usually, if not always and necessarily, made with the aid of long-term financing. Such financing does not exist in ordinary bank credit; risk-bearing capital issues are required, which means capital investment by those who are willing to risk their savings in industrial enterprise.

Private funds have not ventured into new capital investments in anything like the normal rate of the ten-year period from 1920 to 1930. During that period new security issues, exclusive of all refundings, averaged about $3,500,000,000 a year. The final figures for 1935 are not yet in, but they promise to show only a little more than one-tenth of that amount, or about $375,000,000.

When one considers the fact that even in 1929 there were more than 20,000 business failures, that even then more than 47 per cent of all corporations showed net losses instead of profits, it is not surprising, adding the uncertainties of national legislation, new taxes and governmental regulation, that private funds have not been risked in business ventures during past months. General conditions have given strong incentive for those with such funds to continue to hold them in bank deposits, postal savings deposits and government bonds. There has been no shortage of money or credit, but, because of such conditions, an acute lack of risk-bearing capital has retarded sound business recovery. Banks bulged with money, but little ventured into industry.

About 6,000,000 workers will receive employment, some 1,500,000 directly in capital goods manufacturing, and some 4,500,000 in furnishing raw materials, processing, distributing, transporting and servicing, when the worn-out, obsolete equipment of industry is replaced, and production of capital goods is raised to a point as close to the 1929 level as consumer goods industries are now operating. Realization of such employment will break the back of the depression, remove the temptations of uneconomic panaceas, and silence those who talk of the passing of frontiers, of lost opportunity for the young men and women of America. That happy condition is inevitable. It is even now, despite unnecessary handicaps to business and industry, being brought about.

W.S. Knudsen to Speak to Tool Engineers

William S. Knudsen, executive vice-president of the General Motors Corp., will be the guest speaker at the monthly dinner meeting of the American Society of Tool Engineers, at the Fort Shelby Hotel, Detroit, January 9. The meeting will be in charge of R. Lippard, president of the A.S.T.E., and he will also act as toastmaster.

A. S. M. Chapter to Give Course in Metallurgy

A comprehensive course in the fundamentals of ferrous metallurgy is being offered in eight lectures by the American Society of Metals, New York Chapter. Beginning Tuesday evening, January 7, at 7:30 p.m.; the course will be given in the Merchants Association Room, Woolworth Building. It is free to members and the cost to non-members is $5, plus $2 for the reference book. Those desiring to enroll should communicate with T. N. Holden, 1219 Glenwood Road, Brooklyn, N. Y.

Pay-Roll Records Required After Jan. 1

A decision concerning records which employers of eight or more persons will be required to keep under Title IX of the Social Security Act, has been issued by the U. S. Treasury Department. No special form of pay-roll record is prescribed. Records must be maintained adequate to show the gross pay-roll and the total taxable pay-roll, as well as the number of persons employed from time to time. No records of amounts paid to particular employees are required. Employers claiming to be exempt from the tax should keep records to establish their exemption. Copies of the decision will be available at the Bureau of Internal Revenue and at the offices of all Collectors of Internal Revenue as soon as they can be printed.

Billion for Plant Shows Industry's Faith

Herman H. Lind, general manager of the National Machine Tool Builders Association, sees in the current spending by industry for plant modernization and expansion the most convincing evidence that the current business revival is assuming long-range proportions. Further, he expects that the consumer is going to get better manufactured products at lower prices.

Mr. Lind bases these two conclusions on the results of a survey just completed for the association by the National Industrial Conference Board. The program of modernization and plant expansion undertaken in the last six months by American industry adds up to $938,000,000, Geographical distribution gives the Middle West the first place with $531,000,000, the East second with $201,000,000, the South third with $118,000,000, and the West fourth with $88,000,000. The steel industry is the greatest single factor in this outpouring, its projects totalling $250,000,000, and the automotive is second with $100,000,000. Reports from 500 private plants were obtained.

PERSONALS

L. R. Boulware has been appointed vice-president and general manager of the Carrier Engineering Corp., Newark, N. J. For the past eleven years Mr. Boulware has been general sales manager of the Easy Washing Machine Co., Syracuse, N. Y.

K. H. Walther has been appointed secretary and sales manager of the Skinner Chuck Co., New Britain, Co. He has been with the company since 1920 and has been chief engineer for the past several years. Mr. Walther's appointment fills the vacancy caused by the resignation of R. B. Skinner, who has accepted the position of vice-president and general manager of the D. E. Whiton Machine Co., New London, Conn.

Brent Wiley, whose duties for 25 years with the Westinghouse Electric & Mfg. Co. were the development of electrification of the steel industry, has been elected managing director of the Association of Iron & Steel Electrical Engineers.

Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, has been elected president of the American Chemical Society for 1937.

Dr. Lewis B. Stillwell, consulting engineer, Princeton, N. J., has been awarded the Edison Medal for 1935 by the American Institute of Electrical Engineers "for distinguished engineering achievements and his pioneer work in the generation, distribution and utilization of electric energy." The medal will be presented during the Winter Convention of the Institute.

OBITUARIES

William W. Miller, manager of the industrial department of the General Electric Co., Schenectady, N. Y., died Dec. 22. He was 55. Mr. Miller went to work for General Electric at the age of 12 in summer vacations. After other work with the company he completed the course for graduate engineers in 1902. He had subsequent experience in the railway engineering department and the power and mining engineering department, finally becoming manager of the industrial department in 1929.

George Wroth Knapp, 88, director of the National Enameling and Stamping Co., and former director-general, died December 18, at his home near Baltimore. Mr. Knapp was the inventor of numerous metal processes.

P. V. Critenden Jackson, 56, president of the Taylor-Shantz Co., manufacturer of machinery, Rochester, N. Y., died recently from carbon monoxide poisoning.

William MacGregor, 47, general sales manager since 1926 for the Carborundum Co., died Dec. 18 after a long illness. He joined the company in 1912.

MEETINGS

American Engineering Council. Annual meeting, Jan. 9-11, Washington, D. C. Frederick M. Feiker, executive secretary, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers. Winter Convention, January 28-31. Engineering Societies Building, New York, N. Y. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

American Management Association. Conference on personal and industrial relations, Feb. 5-6. Palmer House, Chicago. Association headquarters, 20 Vesey St., New York.

Personnel Research Federation. Fifteenth annual conference, Jan. 8-10, Hotel Commodore, New York. Offices of federation, 29 West 39th St., New York, N. Y.

Society of Automotive Engineers. Annual meeting, Jan. 13-17, 1936. Book Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.

BUSINESS ITEMS

The Butterfield Division of the Union Twist Drill Co., has moved its Detroit store at 1050 Mt. Elliott Ave. to the Boyer-Campbell Bldg. at 6540 Aintoine St., where it will be under the supervision of C. U. Applegate of Union Twist Drill. The stock of ground thread taps, reamers and other tools will be enlarged. R. H. Stitt, representative and sales engineer for Butterfield, will continue throughout the state of Michigan as usual.

Moore Machinery Co., 550 Fifth St., San Francisco, is the new name of the machinery house formerly known as the Herberts-Moore Machinery Co. Chas. E. Moore is president.

The Eaton Mfg. Co. has decided to move its subsidiary, the Eaton-Detroit Metal Co. to the Massillon, Ohio, plant, which will be reconditioned. About 300 persons will be employed there after the remodeling is completed.

The Geometric Tool Co., New Haven, Conn., has appointed Jeffery-Gilles, Inc., Caxton Bldg., 812 Huron St., Cleveland, Ohio, as agent for Cleveland and vicinity. P. A. PRITCHARD, Geometric's direct sales and service engineer who has been in the Cleveland territory for many years, will supplement the work of Jeffery-Gilles, Inc., and will make his headquarters with them.

Metal Products Exhibits, Inc., International Bldg., Rockefeller Center, New York, N. Y., has appointed GEORGE E. PFISTERER, 308 West Washington St., Chicago, Ill., as western representative. The company maintains a permanent exhibition of metals, alloys, plastics and finishes. Mr. Pfisterer has been manager of the Chicago Power Show for several years.

The Monarch Engineering & Manufacturing Co., Curtis Bay, Baltimore, Md., has been incorporated with 100,000 shares of stock at par value of $1 each, to deal in metallurgical furnaces and core ovens. Incorporators are HARRY D. HARVEY, JOHN E. WEYER and H. ELMER SINGEWALD, all of Baltimore.

The Pratt & Whitney Co., Hartford, Conn., has transferred C. G. CUNNINGHAM from the Pittsburgh office to the Chicago office, 564 West Monroe St., to fill the vacancy caused by the death of WILLIAM HUNTER, former manager. The Pittsburgh office is now under the direction of WM. H. HULL, who until recently was general manager of the Eastern plant of the Expanded Metal Co., Jeannette, Pa. Mr Hull was also associated with the General Motors Corp. for several years in engineering work.

Hedstrom Union Co., East Templeton, Mass., manufacturers of pressed steel products, principally toys, will move to Fitchburg, Mass., where Mill C of the Parkhill Mills has been leased.

The Whitney Mfg. Co., Hartford, Conn., has changed its corporate name to the Whitney Chain & Mfg. Co. Founded in 1896 by the late CLARENCE E. WHITNEY, the company manufactures power transmission and conveyor chains and is a large supplier of materials to the automotive, agricultural implement, and general manufacturing industries. No change in company policy or product will be involved.

The L. S. Starrett Co., Athol, Mass., recently acquired the business of Henry A. Lowe Co., of Cleveland, Ohio, manufacturer of the line of "Last Word" indicators. All of the equipment for the manufacture of these instruments has been moved to the Starrett works in Athol.

Cutler-Hammer, Inc., Milwaukee, Wis., has advanced G. S. CRANE, sales manager and W. C. STEVENS, chief engineer, to vice-presidencies. Mr. Crane began his service with the company more than 25 years ago, and Mr. Stevens started with Cutler-Hammer 30 years ago.

The Carboloy Co., Detroit, Mich., has transferred RAY MACK from the general office to the Chicago district office to cover Northern Indiana and Illinois. J. C. KENT of the Detroit distric office has been added to the present sales personnel covering the Southern Michigan territory. J. E. WELDY, Minnesota representative, has been transferred to the Detroit office as assistant to the district sales manager.

EXPORT OPPORTUNITIES

Manufacturing machinery for cereal breakfast foods, puffed wheat and rice, and corn flakes. (Purchase.) Chihuahua, Mexico. *9867.

Elevating platform and warehouse trucks, electric. (Purchase and agency.) Prague, Czechoslovakia. *9866.

Engines, stationary and marine diesel, 3 to 150 hp. (Agency.) Rotterdam, Netherlands, *9865.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

PATENTS

December 10, 1935

Metal-Working Machinery

Grinding Machine Feeding Mechanism. Herbert A. Silven, Worcester, Mass., assigned to Norton Co. Patent 2,023,704.

Centerless Grinding Machine. Harry Hales Asbridge, Claremont, Ashton-on-Mersey, England, assigned to the Churchill Machine Tool Co., Ltd. Patent 2,023,720.

Multiple-Spindle Metal Working Apparatus. Edward P. Bullard, Bridgeport, Conn., assigned to the Bullard Co. Patent 2,023,779.

Two-Motor Control for Screw Feed Machine Tool Units. Edward Joslin Kingsbury, Keene, N. H. Patent 2,023,841.

Hydraulic Feeding Apparatus for Machine Tool Units. Edward Joslin Kingsbury, Keene, N. H., assigned to Kingsbury Machine Tool Corp. Patent 2,023,841.

Work Supports for Machine Tools. Timothy B. Buell, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 2,023,869.

Extrusion Press. John H. Friden, East Orange, N. J., assigned to the Sun Tube Corp. Patent 2,023,879.

Tools and Attachments

Die for and Method of Making Spirally Corrugated Tubing. Stephen Guarnaschelli, Brooklyn, N. Y., assigned to Packless Metal Products Corp. Patent, 2,023,417.

Coated Steel Electrode for Arc Welding. Fritz Muller, Furstenwalde, Germany, assigned to N. V. Machineinn Apparaten Fabricken "Meaf," Utrecht, Netherlands. Patent 2,023,869.

Processes

Means for Assembling and Securing Radiating Fins on Tubes. Arthur J. Mason, West Hartford, and William L. Tancred, Hartford, Conn., assigned to the Bush Manufacturing Co. Patent 2,023,738.

December 17, 1935

Metal-Working Machinery

Cutter Bearing, Kurt Zwick, Munich, Germany, assigned to Friedrich Deckel, Munich-Prinz Ludwigshohe, Germany. Patent 2,024,196.

Routing Machine. Erwin G. Roehm, Norwood, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 2,024,250.

Broaching Machine. Millard Romaine, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 2,024,251.

Broaching Machine. Millard Romaine, Cincinnati, and Erwin G. Roehm, Norwood, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 2,024,252.

Broaching Machine. Millard Romaine, Cincinnati, and Erwin G. Roehm, Norwood, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 2,024,253.

Broaching Machine. Millard Romaine, Cincinnati, and Erwin G. Roehm, Norwood, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 2,024,254.

Pattern Controlled Die-Sinking Machine. Bernard Sassen, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 2,024,256.

Drill Grinding Machine. Edward Bausch, Rochester, and William L. Flad, Irondequoit, N. Y., assigned to Bausch & Lomb Optical Co. Patent 2,024,268.

Shearing Machine. Robert T. Hazelton, Cincinnati, Ohio, assigned to the Cincinnati Shaper Co. Patent 2,024,287.

Metal Working Machinery. Oswald H. Noble and William J. Streuwing, Cincinnati, Ohio, assigned to the Smith & Mills Co. Patent 2,024,535.

Electric Welding Machine. Conrad L. Pfeiffer, Chicago, Ill., assigned to Western Electric Co., Inc. Patent 2,024,597.

Manufacture of Spur and Bevel Wheels. Franciszek Kacper Samek, Miedzylesie, near Warsaw, Poland. Patent 2,024,747.

Cutting Machine. Charles H. Schurr, Cleveland, Ohio, assigned to the Lees-Bradner Co. Patent 2,024,810.

Welding Apparatus. Verni J. Chapman, Schenectady, N. Y., assigned to General Electric Co. Patent 2,024,965.

Tools and Attachments

Gear Shaping Tool. Edward W. Miller, Springfield, Vt., assigned to the Fellows Gear Shaper Co. Patent 2,024,380.

Gear Cutter. Ernest Wildhaber, Rochester, N. Y., assigned to Gleason Works. Patent 2,024,494.

Cutter for Beveled Gears. Morris Dorman, Baltimore, Md. Patent 2,024,914.

Connecting Rod and Piston Testing and Aligning Device. Ewald A. Arp, Minneapolis, Minn., assigned to Storm Manufacturing Co., Inc. Patent 2,025,008.

Processes

Method and Apparatus for Threading Metal Caps. John J. Williams, Wheeling W. Va., assigned to Hazel-Atlas Glass Co. Patent 2,024,262.

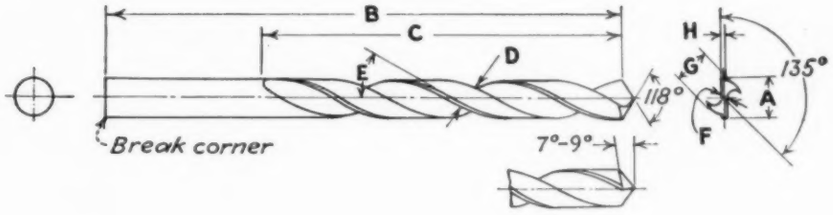
Welding Method and Means. Frederick Galehouse, Boulder City, Nev., assigned to the Babcock & Wilcox Co. Patent 2,024,445.

Method of Making Square-Head Screws. Harrington Moore, Medford, Mass. Patent 2,024,593.

Welded Seam. Clyde C. Farmer, Pittsburgh, Pa., assigned to the Westinghouse Air Brake Co. Patent 2,024,686.

Straight-Shank Drills

This list of "preferred sizes" of straight shank drills was offered by a sub-committee of Technical Committee No. 7 on Twist Drill Sizes at the annual meeting of the American Society of Mechanical Engineers, December, 1935. It eliminates about 150 sizes from older lists and has been found to cover average needs by large users of drills. Details of land width, helix angle, web thickness, clearance diameter and margin width are subject to later development and specification.



Size	Regular Series		Long Series	
	Drill Length	Flute Length	Drill Length	Flute Length
A	B	C	B	C
.0156	1	1/4		
.0180	1	1/4		
.0200	1	1/4		
.0225	1	1/4		
.0240	1	1/4		
.0260	1 1/4	7/16		
.0280	1 1/4	7/16		
.0295	1 1/4	7/16		
.0312	1 1/4	7/16		
.0330	1 1/4	7/16		
.0350	1 1/4	7/16		
.0370	1 1/2	5/8		
.0390	1 1/2	5/8		
.0410	1 1/2	5/8		
.0430	1 1/2	5/8		
.0453	1 1/2	5/8		
.0469	1 1/2	5/8		
.0492	1 1/2	5/8		
.0512	1 3/4	13/16		
.0531	1 3/4	13/16		
.0550	1 3/4	13/16		
.0571	1 3/4	13/16		
.0591	1 3/4	13/16		
.0610	1 3/4	13/16		
.0625	1 3/4	13/16		
.0650	2	1		
.0670	2	1		
.0700	2	1		
.0730	2	1		
.0760	2	1		
.0781	2	1		
.0810	2 1/4	1 3/16		
.0827	2 1/4	1 3/16		
.0860	2 1/4	1 3/16		
.0890	2 1/4	1 3/16		
.0906	2 1/4	1 3/16		
.0937	2 1/4	1 3/16		
.0960	2 1/2	1 3/8		
.0995	2 1/2	1 3/8		
.1024	2 1/2	1 3/8		
.1040	2 1/2	1 3/8		
.1063	2 1/2	1 3/8		
.1094	2 1/2	1 3/8		
.1130	2 3/4	1 9/16		
.1160	2 3/4	1 9/16		
.1200	2 3/4	1 9/16		
.1220	2 3/4	1 9/16		
.1250	2 3/4	1 9/16	4 3/4	2 1/2
.1285	3	1 3/4	5	2 13/16
.1299	3	1 3/4	5	2 13/16
.1339	3	1 3/4	5	2 13/16
.1360	3	1 3/4	5	2 13/16
.1378	3	1 3/4	5	2 13/16
.1406	3	1 3/4	5	2 13/16
.1440	3 1/4	1 15/16	5 1/4	3 1/8
.1470	3 1/4	1 15/16	5 1/4	3 1/8
.1520	3 1/4	1 15/16	5 1/4	3 1/8
.1562	3 1/4	1 15/16	5 1/4	3 1/8
.1610	3 1/2	2 1/8	5 1/2	3 7/16
.1660	3 1/2	2 1/8	5 1/2	3 7/16
.1693	3 1/2	2 1/8	5 1/2	3 7/16

Size	Regular Series		Long Series	
	Drill Length	Flute Length	Drill Length	Flute Length
A	B	C	B	C
.1719	3 1/2	2 1/8	5 1/2	3 7/16
.1730	3 1/2	2 1/8	5 1/2	3 7/16
.1770	3 1/2	2 1/8	5 1/2	3 7/16
.1800	3 3/4	2 5/16	5 3/4	3 11/16
.1850	3 3/4	2 5/16	5 3/4	3 11/16
.1875	3 3/4	2 5/16	5 3/4	3 11/16
.1910	3 3/4	2 5/16	5 3/4	3 11/16
.1935	3 3/4	2 5/16	5 3/4	3 11/16
.1960	3 3/4	2 5/16	5 3/4	3 11/16
.1990	4	2 9/16	6	3 15/16
.2031	4	2 9/16	6	3 15/16
.2090	4	2 9/16	6	3 15/16
.2130	4	2 9/16	6	3 15/16
.2187	4	2 9/16	6	3 15/16
.2244	4 1/4	2 13/16	6 1/4	4 1/8
.2283	4 1/4	2 13/16	6 1/4	4 1/8
.2344	4 1/4	2 13/16	6 1/4	4 1/8
.2402	4 1/4	2 13/16	6 1/4	4 1/8
.2460	4 1/4	2 13/16	6 1/4	4 1/8
.2500	4 1/2	3 1/8	6 1/2	4 5/16
.2520	4 1/2	3 1/8	6 1/2	4 5/16
.2570	4 1/2	3 1/8	6 1/2	4 5/16
.2610	4 1/2	3 1/8	6 1/2	4 5/16
.2656	4 1/2	3 1/8	6 1/2	4 5/16
.2720	4 1/2	3 1/8	6 1/2	4 5/16
.2770	4 1/2	3 1/8	6 1/2	4 5/16
.2812	4 3/4	3 3/8	6 3/4	4 1/2
.2854	4 3/4	3 3/8	6 3/4	4 1/2
.2913	4 3/4	3 3/8	6 3/4	4 1/2
.2969	4 3/4	3 3/8	6 3/4	4 1/2
.3020	4 3/4	3 3/8	6 3/4	4 1/2
.3071	4 3/4	3 3/8	6 3/4	4 1/2
.3125	5	3 3/8	7	4 11/16
.3160	5	3 3/8	7	4 11/16
.3230	5	3 3/8	7	4 11/16
.3281	5	3 3/8	7	4 11/16
.3320	5	3 3/8	7	4 11/16
.3390	5	3 3/8	7	4 11/16
.3437	5 1/4	3 7/8	7 1/4	4 15/16
.3480	5 1/4	3 7/8	7 1/4	4 15/16
.3543	5 1/4	3 7/8	7 1/4	4 15/16
.3594	5 1/4	3 7/8	7 1/4	4 15/16
.3680	5 1/4	3 7/8	7 1/4	4 15/16
.3750	5 5/8	4 1/8	7 5/8	5 1/4
.3860	5 5/8	4 1/8	7 5/8	5 1/4
.3906	5 5/8	4 1/8	7 5/8	5 1/4
.3970	5 5/8	4 1/8	7 5/8	5 1/4
.4062	5 5/8	4 1/8	7 5/8	5 1/4
.4219	5 5/8	4 1/8	7 5/8	5 1/4
.4375	6 1/8	4 7/16	8 1/8	5 7/16
.4531	6 1/8	4 7/16	8 1/8	5 7/16
.4687	6 1/8	4 7/16	8 1/8	5 7/16
.4844	6 1/8	4 7/16	8 1/8	5 7/16
.5000	6 1/8	4 7/16	8 1/8	5 7/16

NEW BOOKS

THE METAL CLEANING HANDBOOK — *By Robert W. Mitchell, Ph. D. 216 pages, 6x9½ in. Published by the Magnus Chemical Co., Inc., 60 South Ave., Garwood, N. J. Price: free to persons inquiring on business letterhead, giving official title or position; to others, $1.*

Cleaning processes have become important steps in production schedules. While the subject of metal cleaning plays an important part in industry, it seldom requires the full services of a metal-cleaning expert in any one plant. This is the reason for publication of this reference book.

After discussing detergent action, the book takes up the five general methods of metal cleaning and shows that labor is the biggest item therein. Following a discussion of equipment and methods, considerable space is given to the action of cleaning materials. Procedures are given for cleaning aluminum and its alloys, brass and bronze, cadmium, chromium, copper, die-casting metal, nickel-silver, silver, steel and iron, tin, zinc and soft metal alloys. The book is very well illustrated throughout, there being a good many illustrations of proprietary equipment and materials, which do not detract from the informative value of the book.

PRACTICAL SHOP MATHEMATICS, VOL. I—ELEMENTARY—*First Edition. By John H. Wolfe, supervisor of apprentice school, Ford Motor Co., and Everett R. Phelps, Ph.D., associate professor of Physics, Wayne University, 331 pages, 5x7 in. Cloth board binding. Published by the McGraw-Hill Book Company. 330 W. 42 St., New York, N. Y. Price $2.20.*

The substance of the course presented in this text was originally offered in loose-leaf form at the Ford Apprentice School of the Ford Motor Co. This book is intended for use not only in factory schools, trade schools and vocational high schools, but also in all high schools to replace the usual geometry course for those students not intending to go to college. Geometry necessary for the solution of practical shop problems, together with the necessary work to give continuity, has been concisely presented in fifty propositions. The authors feel that the geometry as presented and the numerous types of problems which require a combined application of geometry and plane trigonometry are of much greater value to the high school student who is going directly into industry than the usual geometry course.

One of the features of this book is the use of what the authors call the "variable system." Instead of all the dimensions of a problem being given, one has been omitted and its value represented by a letter called the variable. Six or seven values of the variable are given, allowing the instructor to assign separate problems of the same type to a number of students, each of whom will obtain a different answer. This helps greatly in preventing students from comparing work and answers.

Explanations in this text are so presented that a student or mechanic can profitably use the book for home study or as a reference source. Solutions accompanying many of the problems are also a great help to such students.

BOOK OF A.S.T.M. TENTATIVE STANDARDS — *1935 edition. Published by the American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa. Cloth binding, $8 each; heavy paper covers, $7 each.*

This annual publication of the Society contains all of the A.S.T.M. tentative specifications, methods of test and definitions of terms covering engineering materials and the allied testing field. The 1935 edition (1500 pp.) contains 290 tentative standards of which 75 are included for the first time. Some 65 were revised this year and are given in their latest approved form. A complete subject index has been included in the book to facilitate its use.

MATERIALS TESTING THEORY AND PRACTICE—*Second Edition. By Irving H. Cowdrey, associate professor of testing materials, and Ralph G. Adams, formerly assistant professor of testing materials, Massachusetts Institute of Technology. 144 pages, 6x9 in. Cloth board binding. Published by John Wiley & Sons, New York. Price, $1.75.*

Dealing as it does with the fundamental stresses and strains and methods for their determination, this book is intended as a text to accompany a laboratory course, rather than an actual laboratory manual. With this in mind, the authors have presented basic principles which lend themselves to the widest application, omitting certain types of testing considered to be in the realm of specialists. Sections are included to acquaint the student with commonly employed methods in the study of tension, compression, torsion, bending, hardness determination, shock and repeated stress.

This second edition, after a lapse of ten years since the first publication, includes some of the more important improvements and developments in testing technique, equipment and materials. A new chapter has been added on concrete testing, and all specifications cited in the first edition have been revised. Some changes have been made in the text to meet difficulties encountered in the presentation of the subject matter to students during the past ten years.

THE METALLOGRAPHY AND HEAT-TREATMENT OF IRON AND STEEL—*Fourth Edition. By Albert Sauveur, Gordon McKay professor of metallurgy and metallography, emeritus, Harvard University. 531 pages, 7¼x10½ in. Indexed and illustrated. Published by The University Press, Cambridge, Massachusetts. Price $8.*

Dr. Sauveur, dean of American metallurgists, has in this fourth edition brought up to date his classic work on metallography and heat-treatment. Since the first edition was published in 1916, this book has served as the groundwork of much research in metallurgy; many of the most brilliant of today's younger metallurgists frankly avow their debt to Albert Sauveur for his inspiration and guidance.

The present volume constitutes the first revision since 1926; thus it spans a decade during which metallurgical theory and practice has made great progress. Nearly every chapter has been changed to some extent, and two new ones have been added. Subjects covered by the new chapters are "Metallic Crystals and Their Atomic Structures" and "A Simplified View of the Hardening of Steel, of the Transition Constituents and the Microstructure of Steel."

The author has supplied a concise account of the principles upon which the X-ray diffraction analysis of metals rests. He has included material on the aging and nitriding of steel. Some of the views expressed are not in accordance with those presented in previous editions. True scientist that he is, Dr. Sauveur does not attempt to excuse these discrepancies but admits a readiness to discard former theories to accept views better supported by new experimental evidence.

The Round Table

CONCRETE FLOORS

"Williams is talking of putting a new floor in No. 1 shop, Al. And the men are kicking because he's going to use concrete."

"They think it's too hard to stand on I suppose—that's the usual howl when you mention concrete."

"Well it is hard. I've worked on them and I don't like them a bit. Did you ever work on a concrete floor?"

"Sure I have, Ed. I didn't like it any better than you. But this idea of its being hard gives me a laugh."

"Of course it's hard, Al. Isn't concrete harder than maple?"

"If you mean by scleroscope or Brinnel, of course it is. And if you'll tell me how your feet know the difference in hardness I may agree with you. Do you think the maple gives under your feet, or what?"

"I don't know what it is, Al, but I know it's different. Do you know of any place where men really like concrete floors? Don't you always see them standing on boards or wooden platforms?"

"Sure you see boards and racks in many shops, but not in all. I don't believe hardness has much to do with it. You don't see many boards used in the summer, do you?"

"What's that got to do with it?"

"Enough to show that it probably isn't hardness at all, Ed, but heat, or lack of it. Concrete is cold to the feet because it conducts the heat away and makes them seem cold. That's why you think the floors are hard."

"It doesn't sound reasonable to me."

"I was in a shop a while ago that seems to settle the argument. This shop is heated through the concrete floor. There isn't any other heat provided, and the men like it."

"Don't any of them use boards to stand on?"

"Nearly all new men ask for boards —force of habit. And the boss, being wise, gives them the board. In a few days the boards find their way back to the storeroom, and the men never ask for them again. They find the floor doesn't affect their feet because it doesn't draw the heat away and make them uncomfortable."

"I don't want to stand on a hot floor any more than I do a cold one. Why doesn't that draw your feet even if it does keep them warm? Wood for mine, Al, in spite of heated floors."

"The floors aren't hot, Ed, they're just warm enough to prevent cold feet and to heat the shop. No use arguing about it. The only way to convince you would be to try it—and you're probably so stubborn you wouldn't admit you liked it anyhow."

"Is it true that the objection to concrete floors is coldness, not hardness? And will heating through a concrete floor solve the problem?"

DISCUSSION

Open House

In my estimation Al is right, as usual. He should take all the advantages the small shop has to offer in eliminating lost motion.

With Jim the toolmaker on the job and handling tools the way he does, the only things missing are the cage to put him in and a lot of red tape to cut down production. Why should a man leave his bench in a shop like Al's and hang around for a drill or a tap when he could finish the job while he is waiting for and checking an inexpensive tool? Forget the small tool-cost element and think of the time saved on the job itself.

However, there is another important angle, and that is the attitude of the men in the shop. Al said that all his men worked as if they owned the shop, but the more system, especially system of doubtful value, that is added and the more checkups there are on small items, the more his men will feel like hirelings. Maintenance of that ownership spirit alone would be worth the price of a whole lot of small tools. In the big shop it is, of course, necessary to keep accurate track of small tools, but in the small shop, large-shop methods are too expensive because the same cost would be too high per productive unit. —J. C. P. Bode.

Modernizing for Profit

Generally speaking, the small shop should take advantage of the FHA loans. First, the owner will be protecting himself against inflation, and second, he will have a low rate of in-

terest to pay. Individual cases will be governed by just how deep the small manufacturer is willing to become entangled in government financing. Present prices of machine tools are low in comparison to other basic commodities. It is gradually becoming evident to the majority of thinking business men that the future is going to be bright in spite of the brain trusters and other men who are impeding industrial recovery and striving to undermine many years of individualistic determination.

Ed is wrong. Al is not taking too much of a chance and the odds are very much in favor of his making a winning move. Even should the Administration gain complete control of all private plants, Al would be little worse off than if his plant were decrepit and run down. Santa Claus will not be with us many more months, and as Al would be paying low interest to the money lenders because of the so-called government guaranties, he should grasp the opportunity.

—E. E. Gagnon.

A New Line

Let us not be unmindful of the following axiom: "Any commodity readily salable can be manufactured profitably, but not every article readily manufactured can be merchandized profitably."

Provided an "improved" motor possesses proved advantages, the logical procedure for the inventor is to induce a reputable motor manufacturer to participate in the enterprise. Such a concern has available adequate manufacturing facilities, satisfactory sales and service organizations, and an unlimited fund of useful marketing data.

For the small shop manufacturing a standard product and unable to use excess facilities because of unfavorable market conditions, contract work offers the most satisfactory possibilities, and established customers provide the most likely avenues for business procurement.

—Ira S. Williams.

Before considering a new line, such as farm motors, Al should determine if he is leading the field in the compressor business. If he is not, it would be better for him to use his time and his capital in an effort to increase his present business before taking on a new line.

Adding farm motors to the compressor business would be like a hardware salesman taking on a side line of druggist's sundries. While he would probably sell to some of the druggists, his time could be used to better advantage in trying to get new customers for his hardware trade.

When Al feels that he is leading the field in the compressor business, it might be to his advantage to take on a new line that could be sold to his present customers, as his selling costs would be much lower than if he branched out in a new line that would require him to find new ones.

—W. J. Owens.

Al is wise to use due care before sailing on uncharted seas. He cannot know whether he has access to the field or how tight the order-getting process might be until he has actually tried, and his attitude toward tying himself to any royalty contract is well justified.

Except in an extreme case where opportunity knocks so hard as to bat a panel out of the door, any effort toward the establishment of a side line should be aimed at the fields his sales force is now covering.

One would almost conclude that Al has suffered a bump somewhere in the past and learned that real mechanical bargains are as scarce as hen's teeth. Unless and until he can manage to set aside an appropriation that could be lost without wrecking the compressor business, he will do well to continue walking softly. —John E. Hyler.

Yearly Wage

Why not? The stockholders, bondholders, officers and key men all receive annual incomes or salaries in either monthly, quarterly or semi-annual installments. Let's not forget the stockholders; let's not forget anyone, especially the men who make the stockholders' dividends possible.

Stockholders' money cannot produce any tangible goods without the working man, so let us treat them both on the same footing. Be fair about it; when employees are laid off, lay off the dividends.

There was no such thing as security with the old line of thought—we need new leaders. As for the workingmen turning down the yearly wage, some reactionaries will be opposed to any change whatever, even though they would benefit thereby. If put into practice, the yearly wage would go over as all changes do. It would be practicable in any shop if it were put into force universally.

A system by which stockholders, bondholders, executives, insurance companies, banks, utility interests and politicians could receive compensation only in proportion to the national payroll would adjust itself to a minimum guaranteed income for the purchaser—the worker. With a minimum guaranteed income, there would be no lack of orders; there would be a guaranteed market. —W. E. Fischer.

What Is Productive Labor?

The bugbear is found in the much overloaded words, overhead and productive. The idea that overhead charges must be strictly controlled is admirable. It is necessary that what overhead involves be clearly understood. It is here that the appositeness of Al's contention that the kinds of overhead be sorted out is brought out prominently. If the work of foreman, designer and draftsman is to be classed as non-productive labor, then some suitable subdivision is desirable. Otherwise the practical outcome is that the work of the various intelligence departments tends to be looked at somewhat askance as so much necessary evil. There are some who, even today, would omit the qualifying adjective.

In the matter of the designer's work, there is much to be said for the view that it is, in a large sense, productive.

—W. Roland Needham,
Stafford, England.

What About Vacations?

In most plants the matter of vacations need not be a problem. Some shops shut down and give their men vacations during the slack summer period. But some shops cannot afford to shut down, as in our case. When the slack period arrives, half of our working force is given a vacation. I don't mean to say that we just let 50 out of 100 go indiscriminately; we make certain that we have a working force left. Where there are two operators for any one type of machine, one at a time is given his vacation.

Rare indeed is the plant that does not have more than one slack period during the summer months. We have found that another slack period generally follows the first, and it is then that we give the other half of our force a rest.

One might argue that our men do not get their choice of vacation periods, but we find very little complaint about the time vacations are given. Should any man be anxious to take his vacation at a particular time, we try our best to accommodate him.

—Will Herman,
Superintendent, Tanenbaum Oil Co.

DISTORTION...
Its PREVENTION and CURE

H. M. DARLING

E. F. DAVIS' article (*AM*—Vol. 79, page 545) recalled my problems in overcoming distortion in the manufacture of twisted high-speed drills. A few years ago I was employed on experimental work by a company which started the manufacture of twisted drills, made from cold drawn "drill section" steel.

This company did not twist the drills in the usual manner but built a machine with a series of feed rolls and twisting rolls. The machine was set up in front of a heating furnace. The straight fluted blanks, cut to proper length, were heated in the furnace, then pulled out and one end inserted between the feed rolls. The hot blank would feed through the twisting rolls, and emerge from the delivery side of the machine, twisted to the required helix, after which the various finishing operations were performed by grinding to make a completed drill. The finished drill was helically fluted for its entire length and was held in a special chuck or shank, which drove it in operation.

When the drill blanks emerged from the twisting machine they were very crooked and hard to straighten. After the difficult straightening operation, they were hardened, which again caused distortion.

To overcome these troubles, I built a combined hardening and straightening device, which worked as follows:

As the drills came from the high-speed furnace (2,275 F.) they were rolled out onto an iron plate and another plate above was lowered and moved sideways with light pressure, rolling the drill across the lower plate, until it dropped off the edge into a funnel. The drill dropped vertically through the lower end of this funnel into an oil bath. The two iron plates, by their sliding action, would straighen the drill as it rolled and at the same time harden it.

The plates were water-jacketed to keep them cool, and a blast of air blew away any scale or dirt left on them. The air blast also helped to cool the drill.

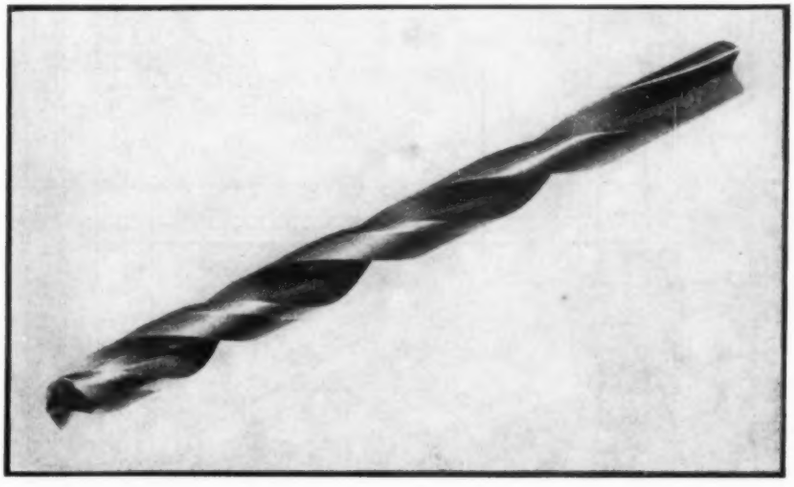
As the drills dropped into the quenching oil they landed in a wire basket. When loaded the basket was drained of oil; the drills were washed in hot soda, and then tempered to 1,075 F. in the usual manner, resulting in a hardness of about 63 to 64 Rockwell C scale.

With the rather crude experimental device, which I built for this work, an operator could harden about 200 ⅜-in. drills an hour. The furnace used had an opening at both ends, and a boy worked at the back of it, inserting preheated drills into the rear of the high-heat chamber. As the drill came from the furnace onto the lower plate, it located against a crosswise stop, which moved with the upper plate, as it rolled the drill.

The device was motor driven, and touching a foot treadle would start the mechanism through its cycle—down, across and up to rest again, ready for the next drill.

All machining operations were performed by grinding. After tempering, the outside diameter was centerless ground, the cutting end rough pointed and the clearance ground on the lands. The clearance extended up to about 2 in. from the shank end, leaving this length, as cylindrically ground on the centerless machine, for holding in the special chuck or socket. After sharpening the point the drill was completed by etching the size on the shank.

As these drills are not made now, this straightening device is not in use; but the method proved itself good, and there may be other applications where it would work out well. Of course it would not air harden all other steels as it did high-speed, but it could be used for straightening other materials.



This twisted drill was hardened and straightened simultaneously by rolling it between two water-jacketed plates. An air blast removed scale

Why Cut Away 88% of Metal?

When, and if, welding comes to be used on all sorts of mechanisms, a lot of machining operations will go by the board. If we can imagine welding up the parts of an airplane engine the figures given by the builder of a well known engine become extremely interesting. The master connecting rod, for example, has 76 operations that reduce the 64-lb. forging to 14.15 lb., or a 78 per cent reduction. Other steel parts have from 40 to 75 operations, which remove from 44 to 88 per cent of the metal as forged, and that's some weight reduction. Of course welding wouldn't eliminate all machining but would save a lot.

And, after all, it isn't as wild a dream as it may seem. For we all remember when all wing fittings were machined from steel forgings or from bar stock. Now welded fittings are common practice. No one wants to introduce a single extra hazard, but many are questioning that this would be the case.

Ideas FROM PRACTICAL MEN

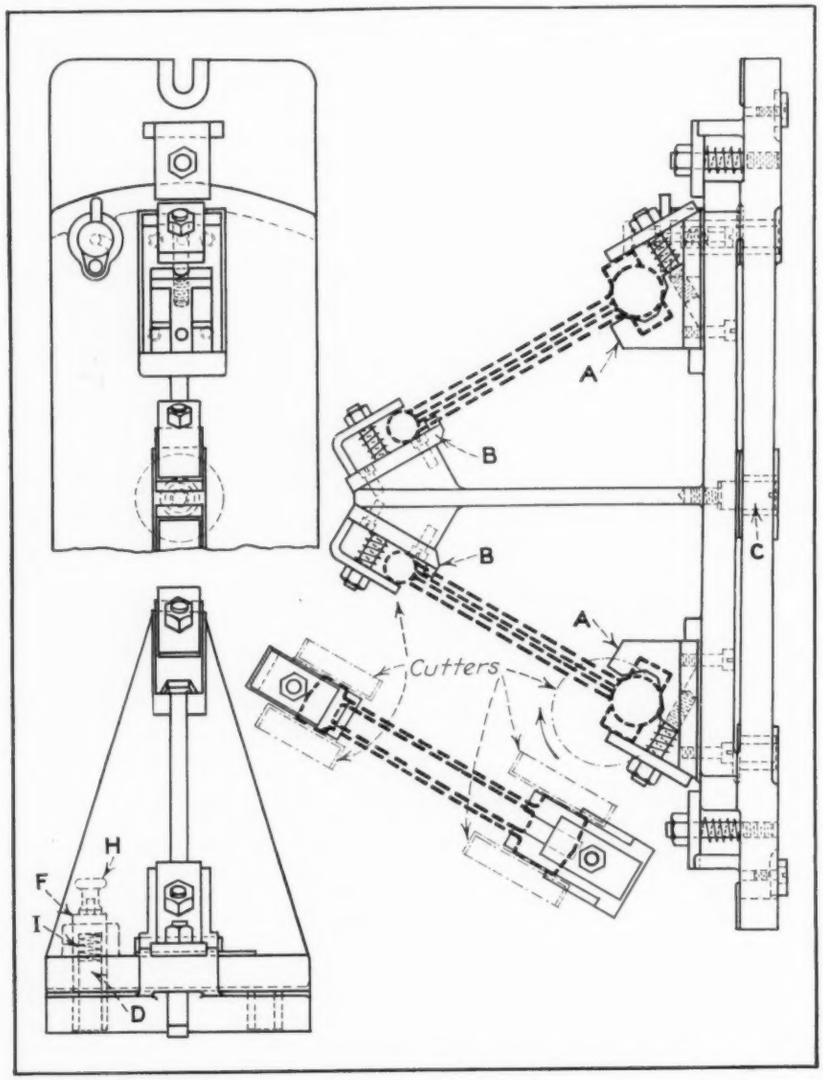
Fixture for Straddle Milling Both Ends of Connecting Rods

EDWARD L. PETERSON

The two-station indexing fixture shown is for straddle milling the ends of the bearings on both ends of connecting rods in one operation, the work being done in a two-spindle machine. The large ends of the connecting rods are located in the hardened and ground V-blocks *A*, and the small ends are clamped against the hardened plates *B*, which have projections on the lower ends fitting loosely between the ribs on the rods. The V-blocks and the plates serve both as supports and locating means for the respective ends of the rods. The widths of the V-blocks and the plates are such that the finished ends of the bearings on both ends of the rods project 0.062 in. beyond their sides, so that a feeler gage of that thickness placed between the V-blocks or the plates and the cutters serves as a setup gage.

The fixture is mounted on a sub-base and can be rotated, the hardened and ground pin *C* engaging a hardened and ground bushing in the sub-base serving as a center. The spring-actuated index pin *D* engages hardened and ground bushings in diametrically opposite sides of the sub-base and locates the fixture in its respective stations. While the rod in one station is being milled, a finished rod is unloaded from the second station and another rod is loaded in its place. When one rod has been finished, the fixture is indexed 180 deg., bringing the rod to be milled into position.

In indexing the fixture, the index pin is withdrawn from the bushing and the spacer *F* is swung under the knob *H* to keep the pin out of engagement. Then the fixture is rotated approximately 180 deg., and the spacer is withdrawn from under the knob. When the pin is over the bushing at the next station, spring *I* snaps it into the bushing.



Both ends of connecting rods are straddle milled at one operation in this fixture. It is used in a two-spindle machine carrying two pairs of cutters

Cutting Small Wormwheels

FRANCIS W. SHAW
Consulting Engineer
Whitworth, Lancashire, England

What I would like to know about all methods of cutting wormwheels without indexing for the required number of teeth and gashing the tooth spaces, is why the hob doesn't generate more than the required number of teeth in the blank.

I have occasionally hobbed wormwheels in both the lathe and the milling machine, but never without previously indexing for the correct number of teeth and gashing the tooth spaces with a narrow cutter set approximately to the helix angle of the worm.

T. B. Wilde (*AM*—Vol. 79, page 596) will find that a hob with a square thread will make an awful mess of the tooth form and, if the number of teeth in the wheel is small, scarcely any of the form will be there when the job is done. Side relief is just as important in a square-threaded hob as it is in one having the Acme form of thread, and the relief is more difficult to file, as any mechanic will know.

Swinging Plate Type of Profiling Formers

FRANK HARTLEY

Two rather unusual set-ups for profiling are shown in the illustrations.

Referring to Fig. 1, the opening *A* in the work *B* is to be roughed and finished by the cutter *C*. For the roughing cut, the former plate *D* is in the position shown, the guide pin being indicated at *F*. After completion of the roughing cut, the cutter and the guide pin are raised to clear the work and the former plate, the nut on the clamping bolt *H* is loosened and the index pin is withdrawn from the hole *I* by depressing lever *K*. The former plate is then swung to the left about the stud *L* as a center until the index pin snaps into the hole *M*. The opening at the right in the former plate is now in the place occupied by the one at the left. The nut on the clamping bolt is tightened, the cutter and the guide pin are lowered into their correct positions and all is ready for the finishing cut.

Since the opening at the right in the former plate is slightly larger than the one at the left, the guide pin in contact with its edges permits the cutter to take the finishing cut.

Referring to Fig. 2, the former blocks *A* and *B* are mounted on the former plate *C*. The work *D* is to have two contours profiled at *F* and *H*, each at a different level, as can be seen in the lower view.

In the position shown, former block *A*, with the guide pin *I*, causes the cutter *K* to profile the lower contour *F*. After that contour has been finished, the cutter and the guide pin are raised to clear the work and the former block, the index pin is withdrawn from notch *L* by lever *M*, and the former plate is swung to the right about stud *N* as a center until the index pin snaps into notch *O*, bringing former block *B* into the position now occupied by the one at *A*. The cutter and the guide pin are then lowered to their correct positions and the contour *H* can be profiled. Since a ledge on the former plate fits snugly under a lip on the retaining plate, it is not necessary to clamp the former plate in position.

Hydraulic Pinion Puller

MICHAEL AXLER

A hydraulic device for removing pinions from their taper seats on armature shafts is shown in the illustration.

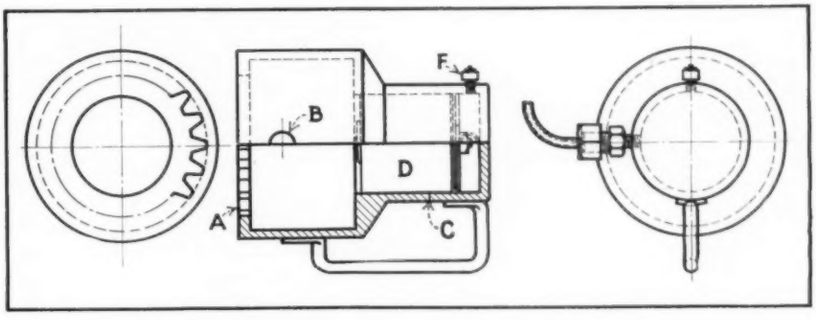
In an inwardly extending flange, at *A*, are teeth forming an internal gear that fit easily in the tooth spaces of the pinion to be pulled. The device is slid over the pinion and is then rotated so as to bring the teeth of both the pinion and the internal gear in line. The relative positions of the teeth can be seen through the hole *B*.

At the opposite end is the cylinder *C* in which is the piston *D* having cup packing. When water under pressure from the pump is admitted to the cylinder, the piston is moved against the end of the armature shaft. As the pressure is increased, the pinion is pulled from the shaft, remaining inside the hollow body of the puller.

To remove the pinion from the puller, the puller is stood on end on the bench, and the pinion is rotated by any convenient tool introduced through hole *B* until the teeth of one gear are in line with the tooth spaces of the other, when the pinion will drop through the internal gear to the bench.

A relief valve at *F* prevents too much pressure in the cylinder.

The puller is passed over the pinion and rotated until the teeth of both are in line



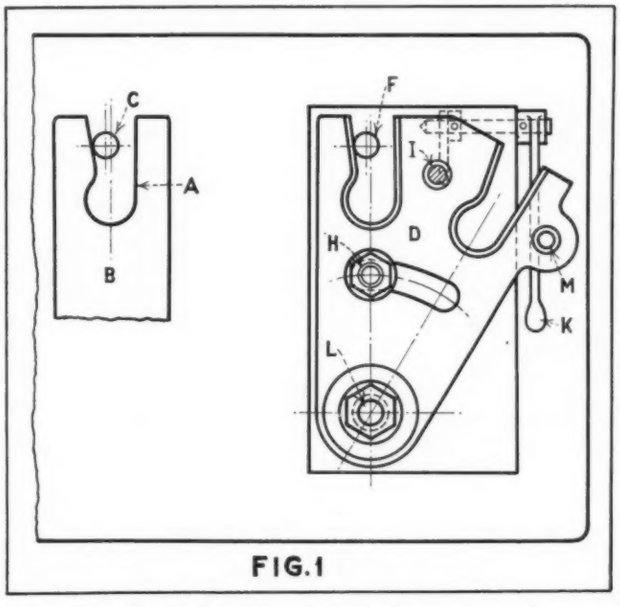


FIG.1

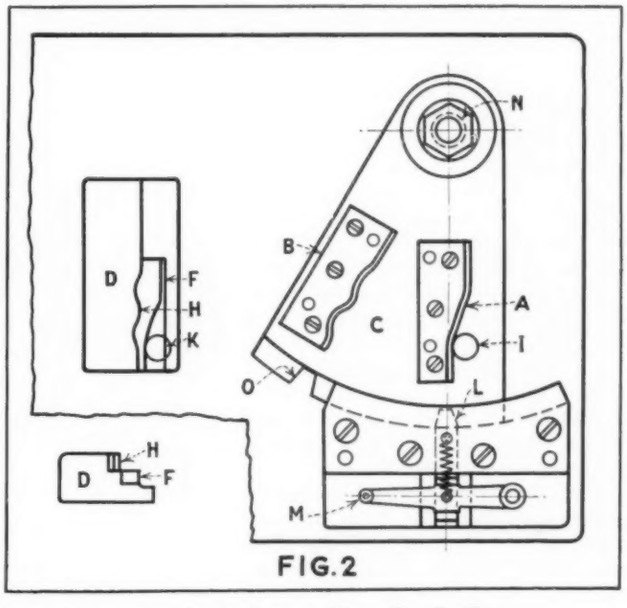


FIG.2

Fig. 1—Roughing and finishing cuts are taken by using two formers cut in the former plate. Fig. 2—Two contours are profiled at different levels. In neither case is the setting of the work disturbed between cuts

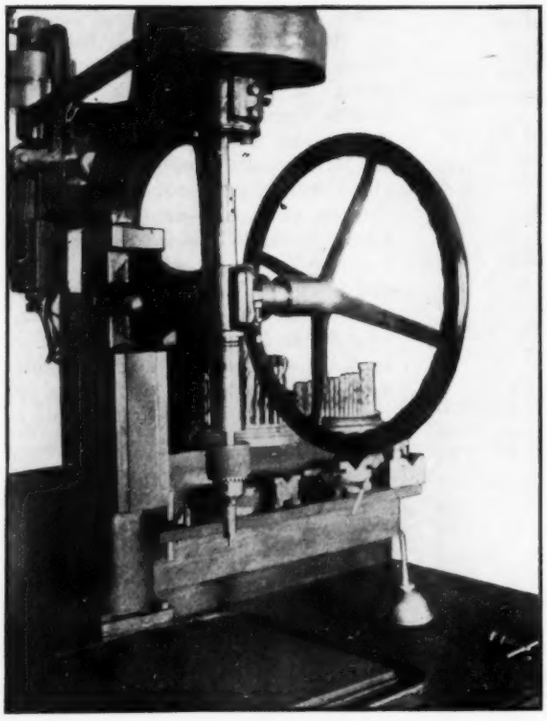
Handwheel for a Sensitive Drill

MALCOLM K. PARKHURST

On the average type of sensitive drill press the spindle is fed by rack and pinion through a hand lever. Although this method of feeding is very satisfactory when drilling small, shallow holes, it frequently happens that the hand lever is at an awkward angle so far as ease of manipulation is concerned. When drilling larger and deeper holes, this condition is more apparent.

A form of feed control that gives the maximum of ease and leverage is that in which a light handwheel of moderate size is used in place of the hand lever. Such an arrangement is shown in the illustration where a steering wheel from an old automobile is used. It might be thought that due to its comparatively large diameter some loss of sensitivity would result, but that is not the case. The wheel readily responds to a featherweight touch when using a No. 60 drill, and to a heavy pull when using drills of larger sizes, due greatly to its lightness.

If the wheel is of the reinforced plastic type it will be both light and strong, whereas an all-iron handwheel of the conventional design would probably not prove to be satisfactory under all drilling conditions.



An automobile steering wheel of the reinforced plastic type attached to the pinion shaft of a sensitive drill press makes an excellent feed control

Method of Testing Squares

C. M. CONRADSON

The method of testing squares shown in the illustration is rapid and extremely accurate. Little equipment is necessary, and most of it can be found in any well equipped shop.

For testing small squares, a surface plate, an angle plate and a sine bar are required. The sine bar *A* is attached to the angle plate *B*, as shown in Fig. 1, by any convenient means, care being taken to have it slightly out of plumb sidewise. The square is placed on the surface plate on one side of the sine bar, as indicated by the full lines, and with the front edge of the blade in contact with the upper disk of the sine bar. The space between the square blade and the lower disk is then tested with gage blocks as at *C*.

The square is then moved to the opposite side of the sine bar, as indicated by dotted lines, and the front edge of the blade is brought into contact with the lower disk. If the same gage blocks fill the space between the front edge of the blade and the upper disk, as at *D*, the square is correct. If, however, the distances between the blade and the disks differ in the two positions, then the square is out of true an amount equal to half that difference.

In mounting the sine bar on the angle plate, the lower end should be far enough above the surface plate to admit the beam of the square beneath it. By this means the inner edge of the square blade can also be tested.

For testing large squares, as in Fig. 2, it is necessary to have a longer test bar than the standard sine bar, which can easily be made as follows: A piece of Shelby tubing of the desired length is countersunk at the ends and the body is ground parallel. Balls of a diameter larger than that of tube are lightly soldered in the countersunk ends of the tube with soft solder, and holes are drilled for attaching the tube to the angle plate. In attaching the tube, it must be blocked out far enough to prevent the lower ball from contacting the angle plate. This applies to small squares as well.

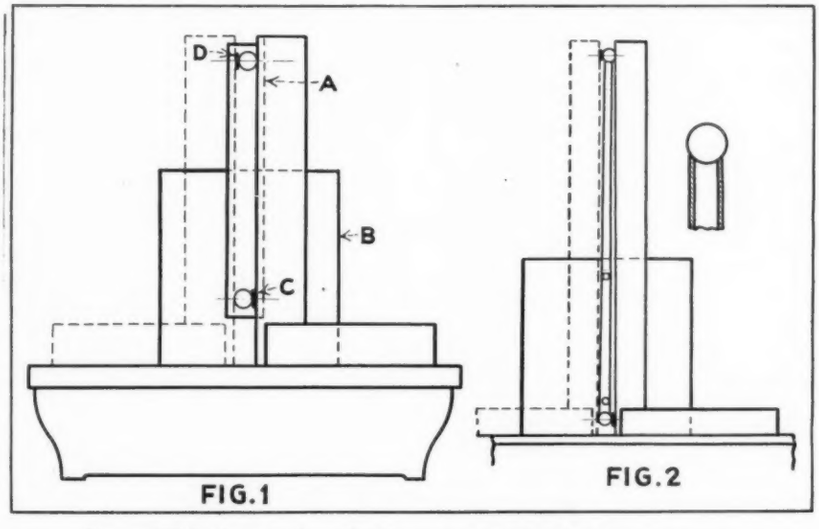


Fig. 1—With the sine bar slightly out of plumb sidewise, the square is alternately placed on each side of it. Fig. 2—Large squares are tested in the same way, but a longer test bar is necessary

A Cabinet for Taps

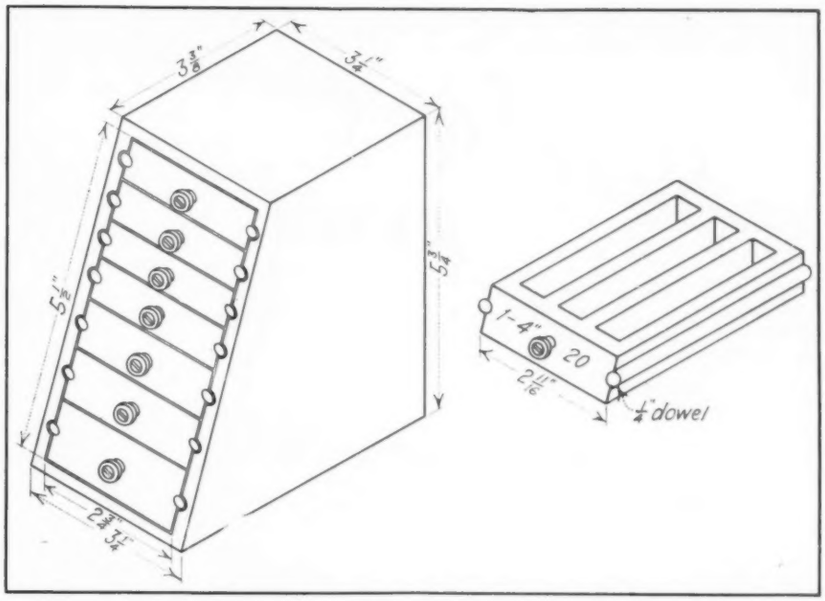
C. F. FITZ

Taps generally come from the manufacturers in cardboard boxes that soon become soaked with oil, and after much use the partitions are broken. Thus the taps are left to roll around in the box, striking together and injuring the cutting edges.

To overcome this difficulty, we made the cabinet illustrated to take care of taps from ¼- to ⅝-in. inclusive. The cabinet is made from ¼-in. plywood and the drawers are made from wooden blocks having pockets cut in them to take care of the various sizes of taps. The entire cabinet is given several coats of black shellac to prevent it from becoming oil soaked. The runners of the drawers are wooden dowels fastened in half-round grooves in the sides of the drawers. The dowels slide in corresponding grooves in the sides of the cabinet.

The sizes of the taps may be painted on the faces of the drawers or stamped with steel stamps. If stamped, the indentations made by the stamps are filled with a paste made of powdered chalk and ammonia.

The use of this cabinet has not only kept our taps in good condition, but has also saved us time in hunting for taps of various sizes.



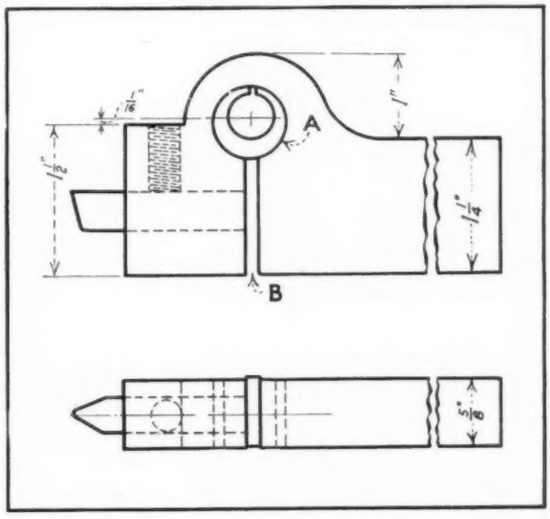
The cabinet is made of plywood and is given several coats of shellac to prevent it from becoming oil soaked. The drawers are made of blocks having pockets for the individual taps

Spring Holder for a Threading Tool

HARRY A. GILLILAND
Hamilton, Ontario, Canada

The spring holder for a threading tool illustrated is one of the most efficient and practical tools used in our shop. It is flexible enough to relieve the toolbit before tearing the work or breaking the tool, yet the work can be run as fast as the toolbit will stand without burning or excessive wear.

By turning the slotted bushing *A* so that the slot is in different positions, flexibility can be varied according to conditions. The slot *B* is rubber filled to act as a cushion to eliminate sudden shocks at the cutting point of the toolbit.



Flexibility of the holder may be varied by rotating the slotted eccentric bushing

Quick-Acting Stub Mandrel

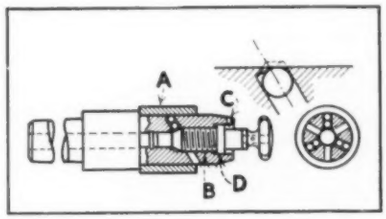
PHIL. E. VERAA

On the stub mandrel illustrated, bushings as at *A* to be finished on the outside by turning or grinding are locked by steel balls.

When the locking screw *B* is screwed in, the balls are forced outwardly by its conical end. The three holes for the balls are drilled at an angle, the drill point breaking through just far enough to expose the outer balls without permitting any of them to escape, as shown in the enlarged view above. The safety screw *C* is provided so that the collar *D* on the locking screw will contact it and prevent the locking screw from being screwed out enough to permit the balls to escape inwardly.

In assembling the balls in the mandrel, the mandrel is held vertically and a rod is inserted in the central hole from the tapered end, its inner end being flush with the holes for the balls. The balls are dropped in and fall into the holes by gravity. The locking screw is then screwed in far enough to prevent the balls from escaping inwardly and the rod is withdrawn.

This mandrel is in use in a manufacturing shop and its operation is quite satisfactory.



The bushings to be finished on the outside are locked by balls forced outwardly by the locking screw. The balls cannot escape because the holes are not drilled through to full size

Shop Equipment NEWS

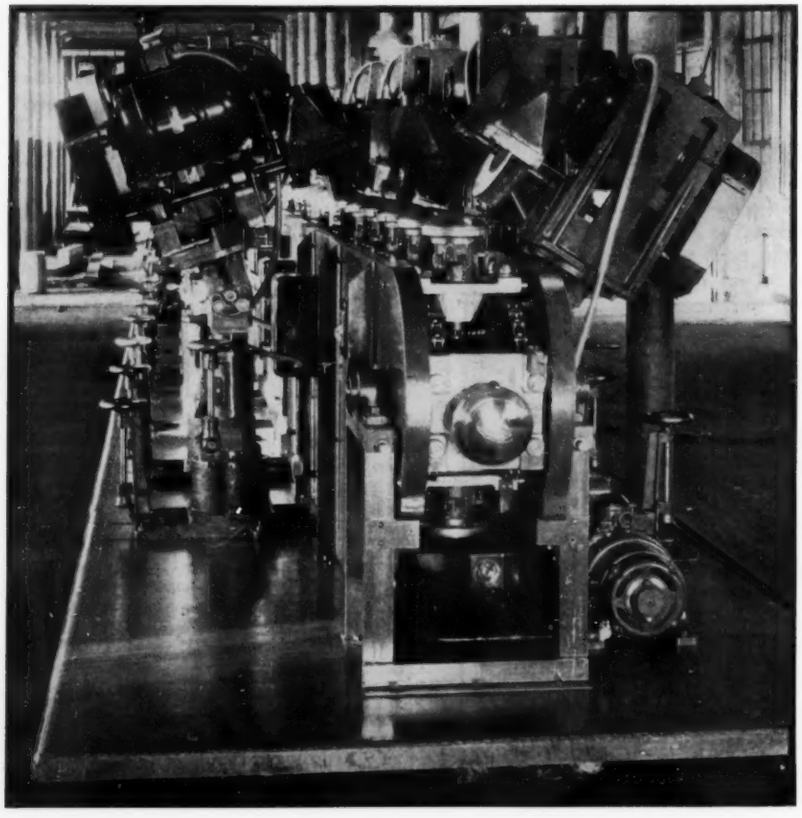
Packer Fourteen-Head Polishing and Buffing Machine

The Packer Machine Co., Meriden, Conn., recently furnished a fourteen-head polishing and buffing machine with a guaranteed hourly production. It is equipped with 38 work-holding fixtures mounted on a conveyor chain moving between the heads, and it is a simple matter to set up the work-fixture platens for a run on a particular product. The manufacturer who has installed the machine makes use of it for several different products.

The machine consists of fourteen wheelheads, each adaptable to any type of polishing or buffing, a variable-speed drive for advancing the work through the machine, and another variable-speed drive for rotating the work while it is being polished. By means of a worm and sector adjustment, the axis of the polishing wheel shaft on any head can be tilted in a vertical direction to place the polishing wheel against any side or surface of the rotating work. The rotating speed of the wheel is adjusted by changing pulleys on the V-belt drive between the motor and wheel spindle. Wheel speeds obtainable range from 2,485 to 3,045 r.p.m. in three steps.

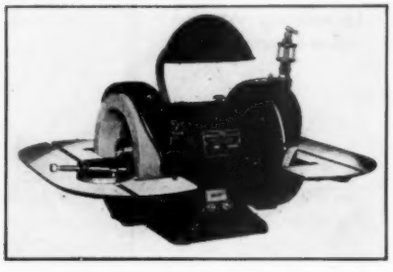
The variable speed for the indexing mechanism is obtained from a 5-hp. motor driving through a New Departure Transitorq. Work is advanced through the machine by a Geneva indexing mechanism. The work spindles are rotated by a separate 1-hp. motor through a small Transitorq and a chain drive. Each of the work spindles carries a sprocket at the lower end which engages along one side with a chain driven by the small Transitorq. Necessarily, this chain runs the full length of the machine. The direction of rotation is such that during indexing the rotational speed of the work decreases, and the polishing wheels rotate in the same direction as the work fixture. Thus, the speed of rotation is usually such that the work fixtures rotate about ten revolutions or less during each period of contact with the wheel. An automatic applicator for applying polish compound to the work wheel is integral with each wheel head.

Specifications: Length of machine, 42 ft. long; width, 7 ft. wide; weight of complete machine, 16 tons; center distances between work-holding fixtures, 24 in.



Prosser Widia Model "AA" Carbide Tool Grinder

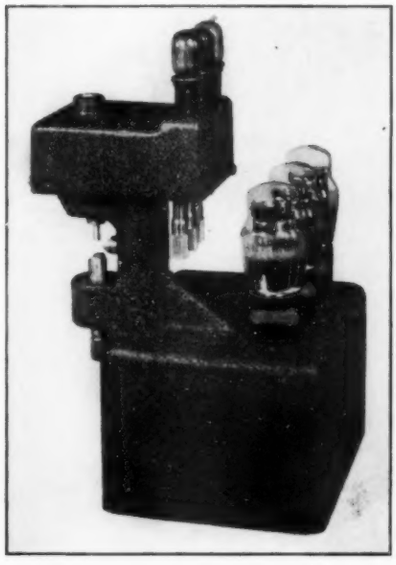
Thomas Prosser & Son, 15 Gold St., New York, N. Y., have added the Model "AA" cemented-carbide tool grinder to their line. This grinder is equipped with two quick-setting tables, slotted, and having graduated indexes. The machine permits both rough and finish grinding of cemented carbide tools with cup wheels which may be either fine-grain silicon carbide or diamond-impregnated. An oil-feeding attachment is furnished when diamond wheels are used. Other types of wheels can be supplied for grinding high-speed steel. Standard equipment includes the lamp, a reversible motor and a combination wheel-dresser, holder and protractor.



"Inspectron" Model LR-2 Semi-Automatic Gage

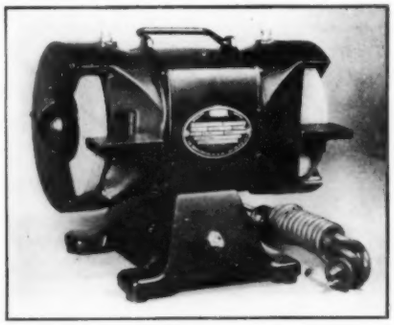
The Electronic Inspection Laboratories, 942 Prospect Ave., Cleveland, Ohio, are building the Model LR2, semi-automatic gage for manual operation on any material up to and including 1 in. in diameter. The piece is inserted into the gage mouth against the back-stop and between the anvil and spindle. There are three lights on the top of the gage operated by three "Inspectron" vacuum-tube relays. If no light lights the piece is undersize, if the first light lights the piece is good and if the second light lights the piece is good, and if the third light lights the piece is oversize. For example, if piston pins are being checked the tolerances would be as follows: all under 1.000 in., undersize; all 1.000 in. and under 1.0001 in., first good size, first station, one light; all between 1.0001 in., and 1.0002 in., second good sorting, second station, two lights; all over 1.0002 in., oversize, third station, three lights. The gage has a sensitivity of 0.000002 in., and can be set to within 0.00001 in. Space is provided for a dial indicator reading to 0.0001 in. which is helpful in setting up the gage.

The gage is provided with an adjustable regulator for spindle pressure and with an adjustable anvil and spindle. The spindle is 3/16 in. in diameter and measuring is similar to the standard pocket micrometer. Considerable pressure can be applied to the spindle without injuring it. Experience shows that cylindrical ground pieces have a fur or feather edge on them that prevents true readings on light pressure, but on this gage the spindle goes through the fur or feather edge.



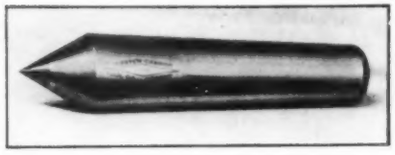
B-Line Bench Grinder

This full ball-bearing grinder, announced by the Brown-Brockmeyer Co., Inc., 1000 Smithville Road, Dayton, Ohio, is capable of performing a large variety of grinding operations. It comprises one 6-in. coarse and one 6-in. fine wheel. The handle for carrying the grinder lies out of the way when not in use. Rubber pads are concealed in the base. The motor is completely inclosed, preventing detrimental effects caused by grinding dust. A safety guide and a convenient toolrest are built into the frame. The grinder is available in both ¼- and ⅓-hp. sizes, 110 volts, 60 cycles.



"Tungsten Carbide" Lathe Centers

The Tungsten Carbide Tool Co., Detroit, Mich., is now making tungsten-carbide tipped lathe centers as regular production. For roughing the new centers permit much heavier cuts than with conventional types. Frequently, the amount of hogging possible is limited by the ability of the centers to stand heavy side thrusts without excessive wear. It is said that this limitation is removed with the tipped centers.

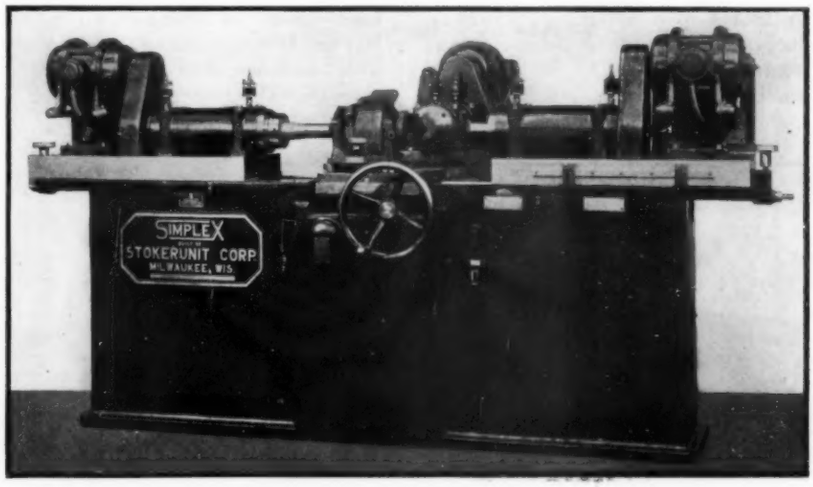


Simplex Precision Boring Machine

Three spindle platens are shown on the precision unit boring machine developed by the Stoker Unit Corp., 5325 W. Rogers St., Milwaukee, Wis. One or more spindles of suitable size can be mounted on each platen. Thus, the machine provides for precision boring of several holes on different faces of a part, and these are bored simultaneously.

A feed mechanism driven by an individual motor drives the feed through pick-off gears. For manual cycle the platens are brought to the work by the handwheel and at the start of the cut a limit switch starts the spindles and engages the feed. A second switch stops the feed at the end of the cut and the platens are returned to starting position by handwheel. In the automatic cycle the electrical control operates a traverse motor. Each platen has individual adjustment in relation to the work, but normally all platens feed at the same rate.

Specifications: maximum feed length, 12 in.; diameter holes, ⅜ to 8 in.; number of spindles that can be used, six of the No. 1 or 1L or three of the No. 3; spindle speed range, 300 to 5,000 r.p.m.; space for fixture, 16 in. sq.; weight of machine, 4,800 lb.



Oliver No. 21 Drill Grinder

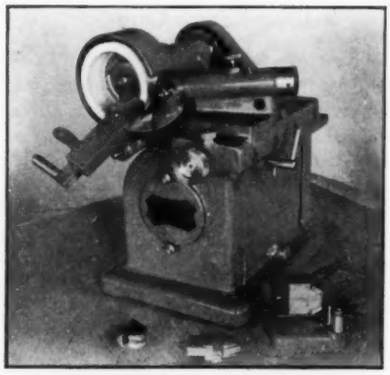
The difficulty experienced in grinding small drills accurately has been overcome, according to the Oliver Instrument Co., Adrian, Mich., with its No. 21 drill grinder. The drill is set in a jig which can be placed where the light is good, and the jig is then transferred to the machine and the drill ground without any further adjustment. The jig consists of a pair of jaws in which the drill can be clamped. A gage is provided for setting the drill. It is then placed in the holding fixture and one lip is ground, the jig is reversed and the second lip is ground. Means are provided to bring both lips exactly to the same length.

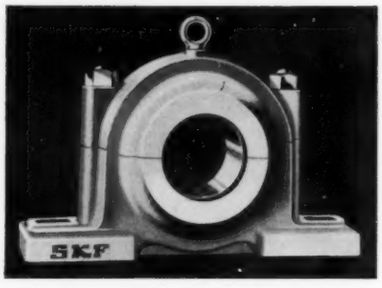
Drills can be ground with various point angles from 80 to 180 deg., and shoulder drills may be ground on the shoulder as well as on the point. The machine can be arranged to grind left-hand drills, and also the thick-web type of oil-hole drills for crankshaft drilling. The rated capacity of the machine is $\frac{3}{32}$ to $\frac{1}{2}$ in. drills, but by means of a collet holder drills from $\frac{1}{32}$ to No. 57 may also be ground.

Quickwork Stamping Trimmer and Beader

A machine that will trim the flash and bead the stamping in one operation and at one pass has been developed by the Quickwork Company, St. Marys, Ohio. It does accurate work on all stampings to be trimmed, beaded or flanged in one plane, regardless of whether the shape of the stamping is rectangular with round corners, or a round stamping, and regardless of whether it is a large or small piece.

The table can be raised or lowered by means of a handwheel which reduces the time required for changing from one stamping to another when small lots are being handled. Main spindles are anti-friction mounted.





SKF SA Type Pillow Block

SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa., is making an SA type pillow block which is self-aligning because of the spherical roller bearings employed. The block is designed with cross and transverse ribbing which assures the most strength and minimum weight. A split construction provides for the least possible number of parts. Sealing rings shield the bearings against dirt and injurious matter. The pillow blocks are available in the free or held type. A locating ring can be applied when it is desirable to locate the shaft.

Madison-Kipp Model 7 Die-Casting Machines

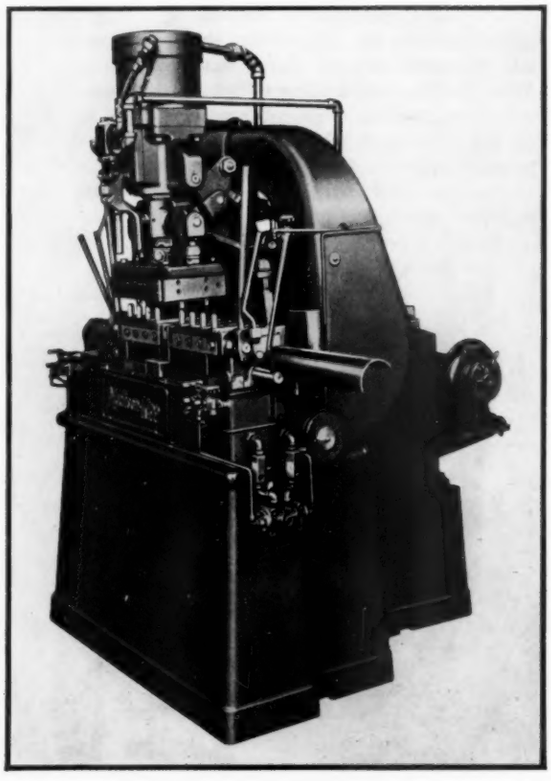
A special-purpose production unit for pressure die-casting of lead- or zinc-alloy parts requiring inserts of other metals or materials has been developed by the Madison-Kipp Corp., Madison, Wis. This Model 7 vertical machine will take multiple-cavity dies. It is fully pneumatic in operation. Cable or rod inserts may extend from the dies as far as necessary in front of the machine. Castings have been made on 5-ft. long inserts.

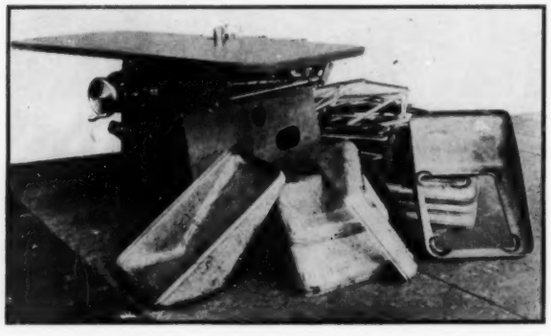
The traveling table is equipped with two sets of multiple-cavity lower die halves. The ram is equipped with one mating upper die half. While castings are being made in the left-hand die, the right-hand die is open so that an operator is free to place a full set of inserts quickly and handily. The ram is raised, the table is indexed, and the right-hand die comes into casting position under

Right—Long inserts may be inserted in the multiple-cavity molds of this Madison - Kipp vertical die-casting machine

▼

Below—Rapid trimming, beading or flanging of a wide variety of stampings can be accomplished with minimum loss of time when changing from one stamping to another



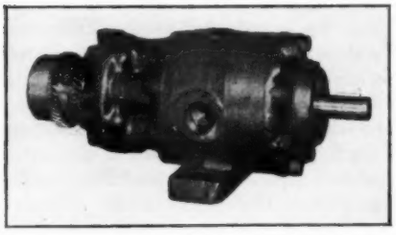


the ram. The left-hand die is moved into the clear at the left of the machine. While a new casting shot is being made, castings in the left-hand die are ejected and new inserts placed, after which the above cycle is reversed.

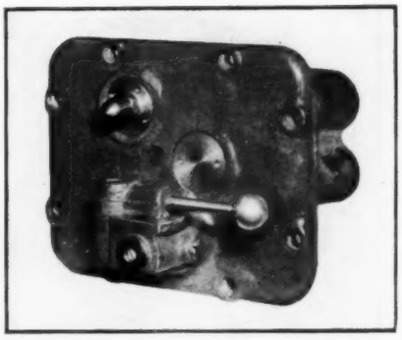
The weight of the machine is 5,800 lb., length 62 in., width 60 in. and height 74 in. Metal pot capacity is 675 lb. of lead while gooseneck or metal-pressure chamber capacity is 13 lb. of lead.

Sundstrand Pump, Control Valve and Circuit

For machine tool feeds and other applications, the Sundstrand Machine Tool Co., Rockford, Ill., is offering a hydraulic pump, control valve, and hydraulic circuit. The pump really consists of two pumps, a variable-displacement pump giving two adjustable feeds and a constant-displacement pump that provides rapid traverse. Both pumps are incorporated in a single housing and driven by a single shaft. The variable-displacement unit is of a multiple-piston type which gives a positive uniform feed. Two pre-set rates of feed are provided, both of which are adjustable throughout their entire range. The constant-displacement pump is a Sundstrand "Rota-Roll" pump, the operating principle of which comprises a roller that revolves in positive contact with a rotor or ring like one of the rollers against the outer race in a roller bearing, thus providing a smooth rolling action and eliminating sliding blades and gears.



Two pumps in one, this Sundstrand unit provides adjustable feeds from one, and constant rapid traverse from the other



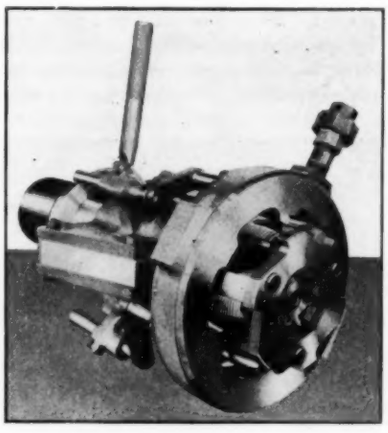
A complete hydraulic feed cycle is provided by this Sundstrand control panel

The control valve, or panel, provides rapid approach, feed, adjustable dwell and rapid return. A second or slower feed can be obtained, and operation of feed and rapid traverse sequence is controlled by adjustable dogs. Jump feed or rapid traverse between intermittent cuts may also be obtained by means of trip dogs. The control panel consists of a pilot, reversing and selector valves, all of which are operated from the low-pressure source. A relief valve is provided for both high and low-pressure circuits.

The hydraulic circuit is a self-locking type which provides smooth uniform feed, shockless high-speed traverses and prevents the tool from jumping ahead at the completion of a cut or during an intermittent cut.

Trip Ring for Landis Collapsible Taps

When tapping any thread, but particularly long threads of large diameter in steel, it is essential to maintain an ample supply of lubricant to dissipate heat and wash away chips. Therefore, the Landis Machine Co., Waynesboro, Pa., has placed on the market an oiling type of trip ring to replace the conventional type of ring usually employed on a collapsible tap. The accompanying illustration shows one of these rings applied to a 6-in. Style LM receding chaser collapsible tap. The ring consists of a hollow housing with steel plates mounted on the front and the back, thus forming a reservoir for the lubricant. On the smaller sizes of rings the housing is made of cast iron, but on the larger sizes it is made of aluminum to lessen the weight. The front ring, which contacts the work to effect the receding and collapsing action of the tap, is made of steel and case carburized.

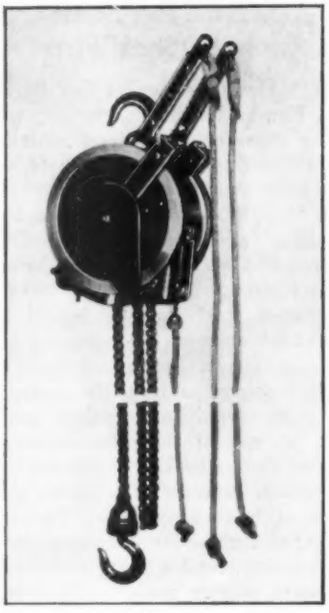


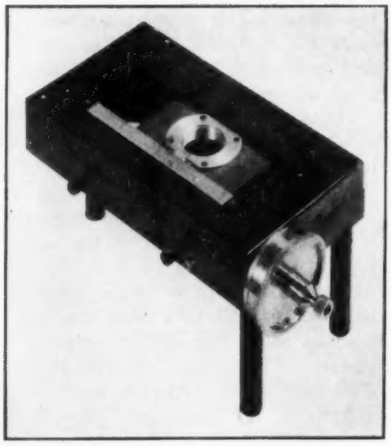
Holes are placed diagonally in the housing through which a stream of oil is forcibly directed upon each chaser throughout the entire length of the cut. A supply pipe with union connection is provided for attaching the supply hose. The housing of the trip ring remains stationary while the front and back plates will turn with the tap if the tap must revolve for tapping the thread. These rings are available for use with Style LM receding chaser and Style LT collapsible taps, 6 in. size and larger.

Coffing Twin Power Hoist

Announcement has been made by the Coffing Hoist Co., Danville, Ill., of a line of spur gear, twin power, gravity lowering chain hoists, to be known as "Challenger." Twin levers, with rope pull, operate on the face of disk wheels by friction grip, eliminating the need for a hand chain to lift the load. To lower the load, it is necessary only to pull on the release rope. A governor controls the speed of operation.

When there is no weight on the hoist, slack in the load chain may be taken up by pulling on the loose end of the chain, or by releasing the clutch, the chain may be pulled out free for quick adjustment. The "Challenger" is made in four capacities; ¼, ½, 1 and 2 tons. First two capacities operate on direct drive, while the 1- and 2-ton capacities have planetary gears.





Mann ball-bearing slide for accurate measurement

Mann precision square available individually or in sets of three

Mann optical flat which is accurate to 1/10 wave length of green light

Mann Slide, Square, and Optical Flat

The Mann Instrument Co., 10 Arrow St., Cambridge, Mass., recently placed three items on the market as follows: a ball-bearing slide, optical flats, and a precision square.

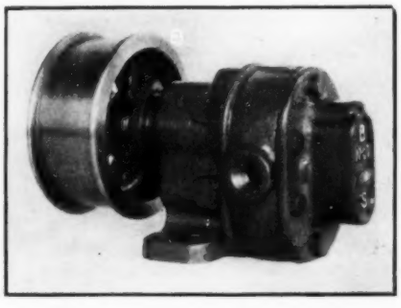
The ball-bearing slide is for use in making accurate measurement by means of a microscope moved by a precision screw. Between the ways is a hardened steel carriage moved by a nut that engages the precision screw. The carriage moves between preloaded ball bearings so that the instrument may be used in any desired position. On the end of the precision screw is a dial graduated in 100 divisions, each of which represents a travel of 0.01 mm. of the telescope slide. An adapter takes a standard microscope, or may be removed and a stage mounted for viewing objects under a fixed microscope mounted separately. Tapped holes are provided in the base so that the instrument may be used with the surface plate, precision square and other products made by the manufacturer.

The optical flats are 4 in. in diameter by ¾ in. thick and are designed for shop, tool-room and laboratory use. They are accurate to 1/10 wave length of green light, but a greater degree of flatness can be supplied.

The precision square measures 4½x-4½x1½ in. and the faces are scraped so that the angle is 90 deg. to within 0.0001 in. in 4½ in.

Brown & Sharpe Helical-Gear Pump

Three rotary geared pumps with helical gears have been placed on the market by the Brown & Sharpe Mfg. Co., Providence, R. I. Known as Nos. 1S, 2S and 3S, these pumps permit higher speeds than models with spur gears and make the pumps available for direct drive at ordinary motor speeds. They also have renewable bronze bearings which can easily be replaced. They are intended primarily for use with comparatively clean liquids such as clean oil, oil emulsion, and soda solution. Pumps run in either direction, but discharge is on the side of the pump toward which the top of pulley rotates. Pumps will raise oil on suction side for a distance of 25 to 35 ft. with tight piping and at speeds above 1,000 r.p.m.



Lincoln "Stainweld B" Welding Electrode

An electrode for welding the group of stainless steels belonging to the 25-12 variety has been announced by the Lincoln Electric Co., Cleveland, Ohio. Because of its higher chromium content the electrode is also suitable for welding the stainless-clad materials. Known as "Stainweld B" it provides weld metal of the same characteristics as steel containing 25 per cent chromium and 12 per cent nickel. The weld metal has high corrosion resistance, high tensile strength and ductility.

Stainweld B electrode is heavily coated and operates on the shielded-arc principle. The weld metal resists a stress of 95,000 lb. per sq.in. It is made in 5/32- and 1/8-in. sizes.

Link-Belt Worm-Gear Speed Reducers

A line of cut-tooth worm-gear speed reducers of compact construction is being offered by Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa. These reducers are available in a wide range of ratios and capacities, with single or double reduction, and in horizontal and vertical types. All are provided with precision tapered roller bearings and automatic lubrication. The output shaft can be located above or below the worm shaft. The accompanying illustration shows a single-reduction reducer with horizontal output shaft above the worm shaft.

TRADE PUBLICATIONS

BAKELITE ANNIVERSARY. The Bakelite Corp., Bound Brook, N. J., has published a 48-page jubilee edition of its house magazine, "Bakelite Review," to celebrate the 25th anniversary of the company. This handsomely illustrated booklet traces the development and history of the company and its achievements in the field of plastics and allied resinoids.

BRONZES. The 1936 edition of the general catalog of maintenance bronzes issued by the Johnson Bronze Co., New Castle, Pa., contains 40 pages, 3 sections. The first section gives complete weight information on completely machined bronze bars, both cored and solid; the second section lists 600 sizes of general-purpose bearings, and the third section deals with electric-motor service bearings.

CONTROLLERS. Air-operated controllers recently introduced by the Brown Instrument Co., Philadelphia, Pa., are discussed in a circular "Tune In for Lower Process Costs."

CUTTERS, DRILLS AND MACHINE TOOLS. New Catalog M published by the Union Twist Drill Company, Athol, Mass., is a complete listing of the milling cutters, gear cutters, hobs, twist drills, reamers and machine tools made by the company. The catalog is more than that, giving much information on the proper use of the tools, and is very completely indexed. An unusual feature is a description of the oldest gear cutter that could be located. This was made by Vaucanson prior to 1782.

"DEBASING THE CURRENCY"—A pamphlet under this title written by E. S. Pillsbury, president of the Century Electric Co., 1806 Pine St., St. Louis, Mo., is available by addressing the company. Mr. Pillsbury includes several charts in his material and shows that the persistence of the price muddle is due to the flexibility injected into the money and credit supply by the Federal Reserve Act of 1913.

DIE CUSHIONS. The Clearing Machine Corp., 6499 West 55th St., Chicago, Ill., has issued a bulletin "Clearing Cushions" showing several developments in die cushions and power press auxiliary equipment. Another folder, "Clearing Duplicators" describes an attachment for milling machines by which they are converted into duplicating machines for dies and molds.

DRILLS. Portable electric drills ranging in size from ¼ to ⅞ in. capacity in steel are shown in Catalog No. 36 issued by Skilsaw, Inc., 3310-20 Elston Ave., Chicago, Ill. Five new models are shown.

EYE PROTECTION EQUIPMENT. The American Optical Co., Southbridge, Mass., has issued a new catalog on eye protection equipment known as Catalog No. 35. It shows various types of lenses, goggles, face guards, and helmets for various industrial uses.

FELT. The Felters Co., Inc., 210 South St., Boston, Mass., has published two booklets on the subject of felt. The first, "Felt Uses," discusses the application of wool felt in several fields, and gives a lengthy list of uses in various products and equipment. The second booklet, "A Study of Vibration in Plant Machinery," discusses the isolation of vibration in various types of equipment and shows the damping action of felt.

FIBER. An engineering data book has been issued by the Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N. Y., covering electrical, mechanical and chemical properties of fiber, "Armite," and "Spauldite."

FRICTION MATERIALS. "Condor" asbestos friction materials for industry are described in a catalog issued by the Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J. There are types illustrated for all kinds of mechanical equipment.

GAS CUTTING EQUIPMENT. The General Welding & Equipment Co., 28 Carleton St., Cambridge, Mass., has published a circular on "Geweco" machine gas cutting equipment, or flame cutting equipment, for cutting shapes from steel plates.

GEAR GRINDING. The Pratt & Whitney Co., Hartford, Conn., has issued Circular No. 420 on the subject of gear grinding and its gear grinding machines.

GOVERNMENT CONTRACTS. The Fidelity and Deposit Co., Baltimore, Md., has published a booklet, "Matters of Procedure Under Government Contract," compiled for individuals who enter into contracts with the federal government, to give a clearer and more complete understanding of the government methods of doing business.

GRINDERS. The Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn., describes its Type 75 and 85 heavy duty knife and face grinders in bulletin No. 78.

GRINDER AND VISE. The Wesson Co., 1050 Mt. Elliott Ave., Detroit, Mich., has published two pamphlets on its diamond-wheel grinder for tool grinding and its three-plane, or universal, vise, respectively. In the one on the grinder are also shown the micro-adjustable for length toolholders, micro boring bars and various high-speed steel and cemented-carbide cutting tools.

GRINDERS. Single-slide internal hole and face grinders are described in a 20-page catalog, issued by the Bryant Chucking Grinder Co., Springfield, Vt.

GRINDERS. The Norton Co., Worcester, Mass., has recently published 7 attractive catalogs describing its various types of grinders. Types of machines included in these booklets are: cylindrical grinders, surface grinders, tool and cutter grinders, the "Cam-O-Matic" cam grinder and semi-automatic grinders.

GRINDERS. Several models of grinding machines are presented in a catalog No. G-4, put out by the Thompson Grinder Co., Springfield, Ohio. The catalog is well illustrated and specifications are included for all models.

GRINDING EQUIPMENT. The Dumore Co., Racine, Wis., has issued two circulars as follows: One covering the Type KG Vari-Speed flexible-shaft tool for grinding, rotary file work, and milling; and the second discusses the No. 44 toolmaker's precision grinder.

HOBBING MACHINES. Bulletin No. 214, published by Gould & Eberhardt, Newark, N. J., sets forth the principles of operation and details of construction of its cone worm and gear enveloping type hobbing machine.

HONING AND LAPPING MACHINE. The Hutto Engineering Co., Inc., Detroit, Mich., has issued a folder presenting its MH-1800-H hydraulically reciprocated honing and lapping machine. Another folder issued by this company describes the Hut-O-Lap machine for accurate production gear lapping.

HOURGLASS GEAR SHAPER. A circular describing the hourglass gear shaper exhibited at the Cleveland Machine Tool Show by the Fellows Gear Shaper Co., Springfield, Vt., is available.

HYDRAULIC FEED UNITS. A circular published by the Hoefer Manufacturing Co., Freeport, Ill., describes the company's self-contained hydraulic feed unit. Some typical set-ups are illustrated.

ABRASIVE CLEANING EQUIPMENT. Wheelabrator Book No. 111, issued by The American Foundry Equipment Co., Mishawaka, Ind., describes the "Tum-Blast" airless abrasive cleaning equipment and shows many applications to various sizes and kinds of products.

LATHE. Circular No. 419, announced by the Pratt & Whitney Co., Hartford, Conn., describes its new model C lathe, in 14- and 16-in. sizes.

LATHES. Bulletins L-1246-C-2 and L-1820-C-2, recently published by the Hendey Machine Co., Torrington, Conn., describes the company's 12-14-16 in. cone head lathes, and 18 and 20 in. machines of similar design, respectively. Illustrations of the various units show clearly the details of construction.

LOANS. The Federal Housing Administration, Washington, D. C., announces publication of its booklet, F.H.A.-180, entitled "Loans up to $50,000." It contains an explanation, provisions and regulations of the National Housing Act.

MACHINED PARTS. Six booklets, put out by the Heald Machine Co., Worcester, Mass., discuss the various setups and machining possibilities of the Bore-Matic as applied to motor vehicle parts, motor and generator parts, electric refrigerator parts, valves and plugs, pumps and compressor parts and others.

MECHANICAL CATALOG, 1935-1936. The American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y., has published the twenty-fifth annual edition of the *Mechanical Catalog*. It is published as an aid in the selection of mechanical equipment to meet the needs of modern plants, the amount of information given depending upon the advertisers of the various products.

MILLING MACHINE. Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati, Ohio, has published Catalog M-660 on the No. 2 universal L-Type milling machine.

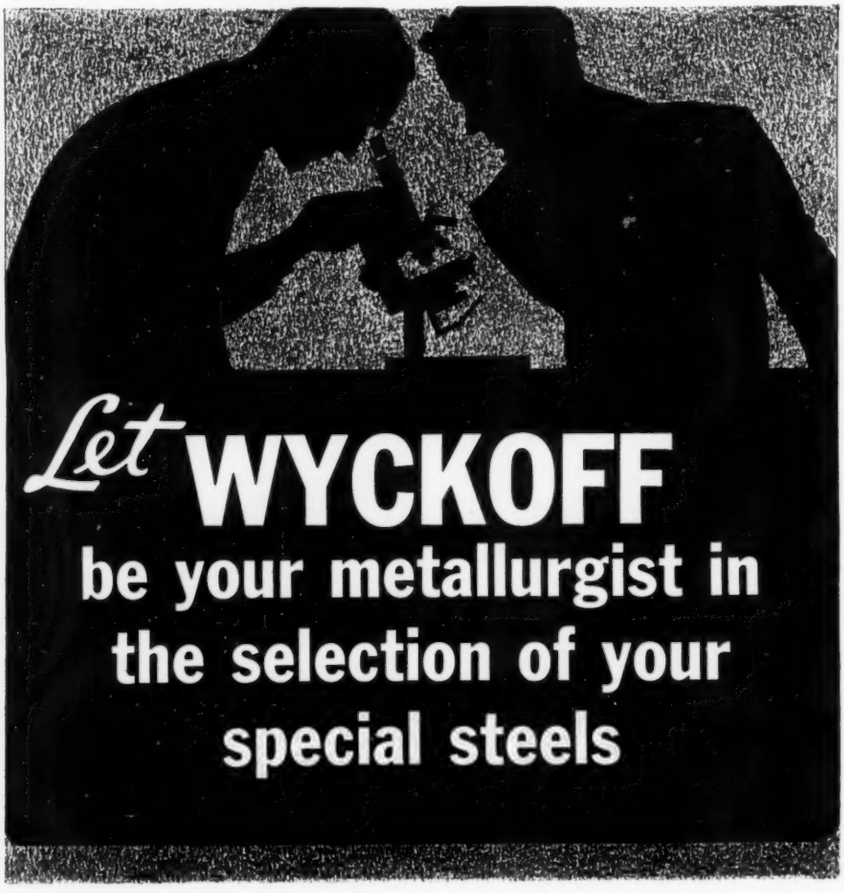
MOTORS. Bulletins 120 and 121 issued by the Reliance Electric & Engineering Co., Cleveland, Ohio, show fully inclosed fan-cooled induction motors in frames 224-365 and 404-585. These motors are of the squirrel-cage type.

NEW YORK UNEMPLOYMENT INSURANCE LAW. 52 questions and answers pertaining to New York's unemployment insurance law have been prepared under the direction of Industrial Commissioner E. F. Andrews of the State Department of Labor. Copies of the leaflet may be obtained free upon application to G. A. Bowers, Director of Unemployment Insurance, State Department of Labor, Arcade Building, Albany, N. Y., or 369 Lexington Avenue, New York City.

NICKEL-CLAD STEEL. A 24-page publication of the Lukens Steel Co., Coatesville, Pa., discusses its nickel-clad steel, shows typical uses, gives a very complete list of applications and much information on fabrication.

NOTCHING PRESSES. The V & O Press Co., Hudson, N. Y., has published a folder describing several of its high-speed notching presses for notching segmental laminations for rotors or stators.

OILSTONES. The Behr-Manning Corp., Division of Norton Company, Troy, N. Y., has published a 36-page catalog presenting Norton oil-stones and abrasive specialties.



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